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This Journal gives prompt consideration to manuscripts reporting *original investigations* in any field of applied psychology except clinical and consulting psychology. A descriptive or theoretical article is occasionally accepted if it deals in a distinctive manner with a problem of applied psychology. The policy is, however, to favor papers dealing with quantitative investigations of direct value to psychologists working in the following fields: Vocational diagnosis and occupational guidance; educational diagnosis, prediction and guidance at the secondary school level and higher; personnel selection, training, placement, transfer and promotion in business, industry and government service including the armed forces; supervisory training in business, industry and government; illumination, ventilation and fatigue in industry; job analysis, description, classification and evaluation; measurement of morale of executives, supervisors, or employees; surveys of opinion on social or political issues, such as those conducted by The Psychological Corporation; psychological problems in market research and in advertising.

Articles may be under 500 words. The maximum is 16,000 words, the average in the neighborhood of 4,000 words. To reduce lag of publication, adherence to the rule of "brevity consistent with clarity" is encouraged.

A lapse of six to twelve months occurs between acceptance of an article and its publication, the lag varying with the rate at which manuscripts are submitted. If, however, an author is prepared to defray the costs of printing the necessary extra pages, he may arrange for earlier publication without thereby postponing the appearance of manuscripts by other contributors. This enables the management to provide space in addition to the scheduled 80 pages per issue. "Early publication" is thus a direct contribution to the subscribers. By cutting down lag in publication, it also benefits those authors whose articles are published in regular turn.

Tables, footnotes and references as well as text of manuscripts should be typed double-spaced throughout. Authors should adhere to the conventions described by J. E. Anderson and W. L. Valentine in "The preparation of articles for publication in the journals of the American Psychological Association," *Psychol. Bull.*, 1944, 41, 345-376. A reprint of this article will be loaned to any prospective contributor who does not find it in his library.

Journal of Applied Psychology

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Opinions of Residents Toward an Industrial Nuisance *

Kenneth E. Clark

University of Minnesota

When is an industrial establishment a value, and when a nuisance to the neighborhood in which it is located? This question is usually answered on an a priori basis by the city fathers who frame and enact zoning ordinances.[1] It may be answered at least as well, however, in terms of the reactions of residents who must live in the neighborhood of a particular plant or area, and whose everyday existence is influenced by its presence. The present paper reports an exploratory study of this question in one area of a large midwestern city, in which the criterion of value or nuisance of an industrial establishment is the expressed opinions of the residents living in the vicinity of the plant.

The Problem

The company whose role is under study is located in what is now an almost completely residential area in a large midwestern city. This residential area is bordered by a heavy industrial area to the north and east, but has grown and enhanced its own value because of its proximity to a large university. Many of the homes nearest the plant represent investments of from $15,000 to $35,000 in terms of 1948 values. The chief industrial "infection" in the midst of this residential area comes from one company, herein called Company X, and from a spur railroad track which runs through the residential area and services this company.

Company X is an oil company which stores and distributes fuel oil, gasoline, and petroleum products. The company is not a newcomer to this area—its plant existed on a small scale before many of the better residences were built in the neighborhood, and pre-dates the present city

* This study was made possible by support from the research funds of the Graduate School of the University of Minnesota.

[1] While it is true that planning engineers are primary participants in determining appropriate land use, and they do attempt to take into account "neighborhood opinion," nevertheless opinion polling techniques are rarely used, if ever, in establishing opinion gradients for zoning purposes.

zoning ordinance which forbids the development of similar heavy industries in this area, or the growth and expansion of the present plant because it is a "non-conforming use." During the past twenty-five years, and especially during the past five years, residents in the area have directed concerted efforts to prevent Company X from establishing more firmly its position in its present location, while Company X has fought with equal vigor to protect its present investment in facilities, and for permission to use more completely the space within its premises as well as to expand beyond its premises.

The renewed attention of the neighborhood was directed to this plant and to the possibilities of danger from the stores of gasoline and fuel oil when during the winter months of 1948 a fire broke out in the garage at 4:30 a.m. and threatened to spread to the rest of the plant. The oil and gasoline storage tanks are within 150 or 200 feet of the garage. Fortunately, the city fire department was able to confine the fire within the walls of the garage in which a dozen or more gasoline trucks burned with a number of minor explosions. It was this occasion which suggested the usefulness of a survey of opinion as a means of reflecting the varied feelings of residents in the neighborhood of Company X. Within a month after this fire occurred, the survey of opinions reported in this article was conducted.

Procedure

A sample of residents in the neighborhood was selected by interviewing one person from every third household as listed in the City Directory. No household existed in the neighborhood which was not listed in this directory. The area included in the survey was limited to that segment which was presumably most affected by the presence of the plant. The geographic area so included was large enough so that some of the households were located as much as two-thirds of a mile from the plant.

Interviewing was done by student interviewers being trained in a course in the principles and techniques of public opinion analysis. Respondents to be interviewed were limited to responsible adults of ages twenty-one or over actually living in the households being sampled. Callbacks were made until interviews were completed or refused, or until it was ascertained that the entire family was out of town, or until four calls had failed to yield results. Usable interviews were thus completed for 144 out of 152 households listed in the sample.

The questionnaire which was used consisted of two parts. The first part contained six questions relating to opinions of the effect of the plant on property values, and on issues of plant building and expansion. The second part of the questionnaire relates to attitudes toward the plant as a hazard which constitutes a threat to their safety. The panel of residents

was also divided into two groups. One groups was the "near" group—those residents who live closest to, and are most affected by the presence of the plant, and a "far" group, which was comprised of residents living at a greater distance from the plant.

Results

Presented below are the responses obtained to each of the questions. The first six questions are presented as a group. The first five deal primarily with plant building and expansion, an issue which is an important one involving several battles in the city planning commission, the city council, and in the courts in recent years. The sixth question taps opinions as to the effect of the plant on residential property values.

		% Yes	% No	% No Opinion
1. "Do you think Company X should be permitted to build a second story on its office building?"	Total	27	54	19
	Near Group	19	60	21
	Far Group	34	50	16
2. ". . . to build a warehouse next to their storage tanks?"	Total	17	76	7
	Near Group	20	76	4
	Far Group	13	75	12
3. ". . . to increase the number of oil and gasoline storage tanks?"	Total	9	83	8
	Near Group	12	84	4
	Far Group	7	83	10
4. ". . . to expand their plant across the railroad tracks?"	Total	6	87	7
	Near Group	9	87	4
	Far Group	4	88	8
5. ". . . to rebuild the garage which was damaged in the recent fire?"	Total	63	27	10
	Near Group	61	30	9
	Far Group	64	24	12
6. "Do you believe that property values in your immediate neighborhood are lowered by the presence of Company X?"	Total	58	27	15
	Near Group	59	27	14
	Far Group	60	26	14

Even though the six questions above deal with the general problem of plant expansion and property values, responses to each are highly specific, and indicate no general "halo" of totally favorable or totally unfavorable attitudes. Thus, while but six per cent of the entire group favor expansion of the plant across the railroad tracks, a large majority (63 per cent) are willing to have the company repair the damage caused by the recent

fire. Equally of interest is the fact that residents *near* the plant express opinions on the six issues presented which are almost identical with those of residents living at a greater distance.

The following questions relate more directly to the attitudes of residents to the plant and its influence in the neighborhood, as a hazard which constitutes a threat to their safety. These responses are likewise presented not only for the total group, but for near and far residents as well.

		% Yes	% No	% No Opinion
7. "Do you believe there is danger to your property from the Company X plant?"	Total	53	38	8
	Near Group	67	28	5
	Far Group	40	49	11

8. "How strongly do you feel about this?"	Answered Question 7: Yes (53%)	No (39%)
Very strongly	55%	14%
Rather strongly	33	25
Not strongly at all	12	44
No opinion	0	17
	100%	100%

		% Yes	% No	No % Opinion
9. "Were you at home and awake during the recent fire in the garage at this plant?"	Total	37	52	11
	Near Group	52	43	5
	Far Group	25	61	14
10. "Did you feel any fear or anxiety about the possibility of fire spreading to your home?" (Asked only of those answering Question 9 "Yes").	Total (N = 53)	32	66	2
	Near Group (N = 34)	47	53	0
	Far Group (N = 19)	5	90	5

The responses to these questions relating to the hazards associated with a plant of this kind certainly suggest that the relative distance between the household and the plant is one of the chief factors which determine attitudes toward the plant as a fire hazard. This is particularly true when one examines responses to the questions directly related to the fire for the near and far residence groups. Further evidence to support this view is obtained when respondents are grouped according to the streets on which they live. On almost every street in the neighborhood, the total pattern of responses of residents near the plant was less favorable

to Company X than for the residents living on the more distant part of the street. This "opinion gradient" is observed when a single total score (based on all questions) indicating favorable or unfavorable attitudes toward the plant is used. However, the responses to individual questions presented heretofore suggest that this gradient results primarily from differences in feelings regarding danger from the plant rather than from differences in feelings about plant expansion and property values.

Two different dimensions of opinion seem, therefore, to exist. The first dimension deals with the influence of this "nuisance" plant on the residents in the community, with primary emphasis on the effects it has on property values, and the desirability of living in such a neighborhood. On this dimension, little difference is observed between the near and far residents. That there should exist such an absence of differences of opinions between groups living in the shadow of a large oil storage plant and groups living at a distance may be a result, in part, of the vigorous campaign of education which has been conducted by the local residents' improvement association regarding the desirability of restricting a "non-conforming use" plant in the area. This "leveling" of attitudes is an an indication of the success with which this association has conducted its educational campaign. As a matter of fact, at two annual meetings of the group and in the mimeographed annual reports sent to all members, an outstanding authority on city planning had presented the basic principles of zoning and appropriate land use, stressing the problems of blight in residential areas as a result of failure to protect such residential areas from encroachments of industry in general and of non-conforming nuisance industries in particular.

Fully as significant as this absence of difference in opinions of near and far residents regarding their property values is the marked difference between these two groups regarding their fears and anxieties arising from the recent fire, and the possibilities of another and more serious fire of catastrophic proportions. The responses to two free answer questions clearly highlight this difference, as do the responses to questions seven through ten. Typical comments regarding the plant were: "Definite danger from explosion and fire. The traffic is also too heavy for a residential area partly due to the plant." "It's a fire hazard." "When the wind is blowing from that direction, there is danger to my home in the event of an explosion." "Could explode at any time . . . it was just a miracle that the fire department was able to control it . . . that's all that saved us." "The trucks are a danger to the children." "The gasoline tanks are the only cause of concern." "So much gas and oil—an explosion might involve anyone within a quarter of a mile or half mile radius." "There is always danger from an explosion. In this last fire,

what if the fire had reached the tanks?" "Danger of explosion. We're close enough here. It would probably blow the windows out of the place." "The fire hazard is the particular thing. A bad fire could seriously damage the community." "From fire and then the traffic and loading—so many trucks and trains." "I think we are all in danger from a real big fire. If those barrels of tar had gone up in the air in the earlier warehouse fire it would have been bad. Another fire would be on a bigger scale."

Eleven per cent of the total sample commented on another free answer question asking whether any steps had been taken to protect property during the fire. Some of the comments follow: "No. What can you do? Didn't know what steps to take. Before the war we wanted to sell and get away, and then thought we'd better stay some place." "Figured there wasn't much we could do—just stand and watch." "We carried valuables away from the house. Smoke was rolling in the windows. Rooms filled with smoke." "Got personal papers ready to leave." "Not much we could do." "Got dressed and ready to leave if it spread. Nothing possible to protect property." "Got children up and dressed in case they'd have to move." "We just got away from here. We were protected by firemen." "We took things into kitchen."

When the responses to all items on the questionnaire are summated, assigning plus values to responses favorable to Company X and minus values to unfavorable responses, it is possible to obtain a distribution of scores which reflects degrees of attitudes towards the company. These summated response distributions indicate a less favorable attitude towards Company X on the part of those households living close to the plant than exists for those living farther away. The extent to which these feelings are fear and anxiety responses rather than responses based on property issues is indicated when separate scores are obtained for items 1 to 6 and for items 7 through 10. In the latter group of items was included a scoring of responses to the two free answer questions intended

Table 1

Means and Standard Deviations of Distributions of Scores for "Near" and "Far" Residents on Attitudes on Plant Expansion and Effects of Plant on Property Values, and on Attitudes of Fear and Anxiety Toward the Plant as a Menace to the Community.

	"Near" Residents (N = 67)		"Far" Residents (N = 77)		Mean	
	Mean	SD	Mean	SD	Diff.	C.R.
Score on Plant Expansion and Property Value Questions.	8.45	3.39	8.34	2.95	0.13	0.22
Score on Fear Questions.	4.91	2.28	3.92	2.33	0.99	2.58

to indicate strength of feelings. Means and standard deviations are presented in Table 1 for the distribution of scores on attitudes regarding "property" issues, and on "fear" attitudes, for both near and far residents. These results indicate differences significant at the one per cent level between near and far residents on fear issues, but negligible differences between these residents on property issues.

Discussion

The preceding analysis and presentation indicates the feasibility of using public opinion techniques for collecting data to point up the need for continuance or change of zoning policies toward specific "sore spots" within municipalities. Of particular interest in this survey is the finding that distance from an industrial establishment has a marked influence on the reactions of residents in the neighborhood to its possible danger, and, perhaps, may also indicate annoyance with the traffic which develops because of its presence. Thus, an easily determined "fear gradient" can be disclosed. The presence and the intensity of the anxiety is found to be inversely related to the distance at which residents in the neighborhood live from the "fear object."

On the other hand, distance from the establishment is found to have little influence on attitudes towards plant development and expansion when good lines of communication exist among the residents of the neighborhood. Thus, in the present survey, a long-time program of education by the community organization has so directed the attention of the residents at a distance from the plant to its effect on them and their property as to eliminate almost completely the factor of distance in determining opinions regarding the effect of this particular company's presence on property values throughout the surrounding residential area.

The survey here reported suggests the possibility, indeed, the desirability, of a policy of adding opinion polling experts to the staffs of city planning commissions to measure the opinions of residents and of industrialists in those areas where sharp conflict exists. Such opinions could also be measured from time to time to determine shifts of opinion which should be taken into consideration in policy determination. Perhaps the method of public hearings, now universally used, will come to be supplemented by scientific evidence of opinion, fairly and systematically gathered. Here is one more area in which the science of public opinion polling can be utilized as a means of providing public policy makers with data now provided only in a haphazard manner by those who are able and willing to attend public hearings. The democratic process of giving all concerned a "hearing" would be enhanced by the polling technique which gives the members of each and every group an

opportunity to be heard, by means of data systematically gathered, and objectively analyzed and reported.

Summary

1. Opinions of residents in the neighborhood of an industrial nuisance, a gasoline and oil storage and distribution center, were determined as evidence regarding the appropriate zoning of this area. A majority of residents in the area held opinions unfavorable to expansion or entrenchment of the plant in the neighborhood.

2. When residents were split into two groups, one living near the plant, the other living at a greater distance from the plant, little difference is observed between groups in their attitudes towards plant expansion and towards the effect of the presence of the plant on their own property values. Marked differences are observed, however, when opinions towards the plant as a serious threat to their safety and the safety of their property is tapped, the group living near the plant displaying more fear and anxiety than those living at a distance.

3. These findings suggest the desirability of use of opinion polling techniques as an aid to planning authorities, not only to give guidance in the zoning of communities, but to assure that each group in the neighborhood has an opportunity to be heard.

Received March 10, 1948.

The 97th Psychological Barometer *

Henry C. Link and Albert D. Freiberg

The Psychological Corporation, New York City

The great issue in the world today seems to be that between state capitalism (sometimes labelled fascism, communism, socialism, totalitarianism) and private capitalism (sometimes labelled free enterprise or the American way of life). The *Psychological Barometer* has included some questions which bear directly on this issue.

Faith in Government vs. Faith in Business Management

In the April *Psychological Barometer*, a question asked in three previous *Barometers* was repeated to measure trends in people's attitudes toward Government control and management of business. The results of the four studies are given below.

Q. "If all manufacturing companies were completely managed by the Government instead of by private management as at present, would you get more for your dollar or less?"

	Oct. 1945	May 1946	May 1947	Apr. 1948
Would get less	38%	35%	36%	49%
About the same	24	9	14	10
Would get more	19	24	20	20
Uncertain	19	32	30	21
Total Interviews	2500	5000	5000	2500

The greater efficiency of private management as compared with Government management is much better recognized today, according to these results, than a few years ago. The latest results show that faith in the efficiency of the Government is highest among the less educated and the skilled and semi-skilled "C" and "D" wage earners group, and among respondents in union families.

* This survey is the 97th in a series of *Psychological Barometers*, the oldest nation-wide poll of public opinion and buying habits now in existence. Begun in March 1932, these surveys are made four times a year with 10,000 personal interviews and twice a year with 5000 interviews. Details of sampling and method are given at the end of this report.

	Socio-Economic Groups				Union Membership	
	A	B	C	D	Union Members	Non-Union
Would get less	62%	57%	46%	36%	45%	51%
About the same	6	9	11	10	11	9
Would get more	13	17	20	29	24	19
Uncertain	19	17	23	25	20	21
Total Interviews	250	750	1000	500	698	1802

Another question pertaining to people's faith in the Government as compared with their faith in business and in unions was:

Q. "In the long run, who does the most for the good of the workers: their employer, the Government, the unions?"

	Total	Socio-Economic Groups				Union Membership	
		A	B	C	D	Union Members	Non-Union
Employer	37%	50%	45%	35%	23%	24%	42%
Unions	35	24	30	38	43	55	28
Government	15	10	13	13	21	11	16
Uncertain	13	16	12	14	13	10	14

Again, there is considerable variation between the opinions of people in the upper socio-economic levels and of people at the lower end of the scale, and between respondents in union families and other people.

Three other questions related to people's faith in Government and private enterprise were also asked:

Q. "If you could choose any job you wanted to, would you rather work for a private business company, or for some department of the Government?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Private company	61%	79%	68%	58%	45%
Government department	33	18	27	34	48
Uncertain	6	3	5	8	7

Answers	Sex		Union Membership	
	Men	Women	Union Members	Non-Union
Private company	65%	56%	53%	63%
Government department	31	35	40	31
Uncertain	4	9	7	6

Q. "What is the safest way to invest your savings: in a savings bank, in life insurance, in Government savings bonds, in bonds of leading companies, in stocks of leading companies, in real estate?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Government savings bonds	65%	66%	65%	65%	64%
Life insurance	13	16	15	13	9
Savings bank	11	3	9	12	15
Real estate	9	10	11	8	8
Stocks of leading companies	1	2	1	1	1
Bonds of leading companies	1	2	1	1	1
Uncertain	4	6	3	3	6

Q. "Where will your savings earn the most money and still be fairly safe?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Government savings bonds	45%	36%	43%	47%	51%
Life insurance	8	11	9	8	6
Savings bank	6	4	4	7	10
Real estate	12	13	15	12	9
Stocks of leading companies	8	11	11	7	5
Bonds of leading companies	5	8	7	3	2
Other	5	7	5	5	5
Uncertain	11	12	8	11	13

People in all walks of life have a higher regard for Government savings bonds than for any other form of investment, both in respect to safety and profit.

Free High School and College Education

In view of the recent report of the President's Commission on Education recommending that the Government provide a college education for every boy and girl, the results of the following two questions are of particular interest.

Q. "Do you believe every boy and girl is entitled to a four-year high school education paid for by the State or Government?"

	Total	Socio-Economic Groups				Sex	
		A	B	C	D	Men	Women
Yes	87%	86%	86%	87%	88%	86%	88%
No	9	10	11	9	7	11	7
Uncertain	4	4	3	4	5	3	5

Q. "Do you believe that every boy and girl is entitled to a four-year college education paid for by the State or Government?"

	Total	Socio-Economic Groups				Sex	
		A	B	C	D	Men	Women
Yes	39%	27%	35%	40%	52%	38%	41%
No	51	65	58	50	35	54	47
Uncertain	10	8	7	10	13	8	12

The general public then does not concur with the President's Commissions report on college educations.

The principal reasons given by the people who were opposed to a Government paid four-year college education for every boy and girl were as follows:

	Total
Better for initiative for people to stand on their own feet; students should work their way through college; it's a family responsibility; shouldn't be a gift	33%
Too many unqualified people would go and therefore our educational standards would be lowered	27
Too expensive; taxes would be too high	16
Only if people are qualified for college; only if they have the mental capacity	7
High school education is enough; college education isn't necessary for everyone	5
Not democratic; not the Government's responsibility	5

Those favoring a free college education for everyone, when asked why, gave such answers as:

	Total
Many who need and want higher education can't afford it; would give everyone an equal chance	26%
People need a college education to get along	16
Deserving and qualified people should get college education	13
Would make a better world; would raise the standard of living	12
People are entitled to it as citizens; the Government should help children	11
Taxes are high enough to cover it; it should be paid for by taxes	11

Labor Saving Machines and Employment

Q. "Do new labor saving machines like steam shovels, cotton pickers, power lawn mowers, etc., increase or decrease the number of jobs in the long run?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Increase jobs	48%	57%	55%	47%	32%
Decrease jobs	45	38	39	45	55
Uncertain	7	5	6	8	13

In spite of the conspicuous example of the effect of machinery in the United States, almost one-half the population still clings to the fallacy that machines decrease jobs in the long run. Education still has a big task to perform at this point, especially among women.

Answers	Sex		Union Membership	
	Men	Women	Union Members	Non-Union
Increase jobs	54%	41%	42%	50%
Decrease jobs	39	51	49	43
Uncertain	7	8	9	7

Strength of Anti-Communism in the U. S. A.

Two different questions were asked on Communism in the April survey:

Q. "Which of these two statements expresses your own idea best: (1) Communism is like other political parties in the U. S. A. which try to put over their ideas; or (2) Communism is like a fifth column which is loyal to Russia first and to the U. S. A. second?" The unanimity of the urban population on this question is of particular interest.

Answers	Total	Socio-Economic Groups				Union Membership	
		A	B	C	D	Union Members	Non-Union
Communism like a fifth column	74%	83%	77%	73%	66%	73%	74%
Communism like other parties	10	9	11	10	9	10	10
Uncertain	16	8	12	17	25	17	16

Q. "If the Communists take over Italy as they took over Czechoslovakia, should the United States declare war on Russia?"

Answers	Total	Socio-Economic Groups				Union Membership	
		A	B	C	D	Union Members	Non-Union
Yes	31%	29%	31%	31%	33%	34%	30%
No	46	54	48	45	39	45	46
Uncertain	23	17	21	24	28	21	24

Palestine

Q. "Are you in favor of splitting Palestine into two parts, one for the Jews, the other for the Arabs?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Yes	45%	43%	46%	46%	39%
No	27	29	28	29	25
Uncertain	28	28	26	25	36

There was practically no difference between various income levels on this question. However, people from the East and Far West were slightly more in favor of partition than people from the Mid-West and South.

Answers	Geographic Areas			
	East	Mid-West	South	Far West
Yes	50%	42%	38%	46%
No	23	31	31	28
Uncertain	27	27	31	26

Although almost one-half of the American people are in favor of partitioning Palestine so as to make a separate Jewish State, 60 per cent, as shown below, are against sending soldiers to help enforce this partition.

Q. "Would you favor sending U. S. troops to Palestine to keep order?"

Answers	Total	Socio-Economic Groups			
		A	B	C	D
Yes	25%	20%	26%	24%	26%
No	60	69	61	61	52
Uncertain	15	11	13	15	22

Here again, there were no important differences by income groups. The Mid-Western respondents, however, were most strongly against the sending of soldiers to Palestine.

	Geographic Areas			
Answers	East	Mid-West	South	Far West
Yes	28%	20%	26%	25%
No	58	67	55	57
Uncertain	14	13	19	18

A cross analysis of the answers to the two questions shows that only 15 per cent of all people questioned are both in favor of the partition and in favor of sending troops.

Is the Oleomargarine Tax Fair?

Attempts to remove the ten cent a pound tax on pre-colored oleomargarine have met considerable opposition in Congress. Yet, three-fourths of the urban population said they believed this tax was unfair when they were asked:

Q. "You pay a tax of 10¢ a pound on oleomargarine if it is colored before you buy it. Do you think this tax is fair or unfair?"

		Socio-Economic Groups			
Answers	Total	A	B	C	D
Unfair	75%	77%	78%	74%	70%
Fair	14	11	12	15	16
Uncertain	11	12	10	11	14

	Sex		Geographic Areas			
Answers	Men	Women	East	Mid-West	South	Far West
Unfair	79%	71%	74%	75%	77%	73%
Fair	13	15	13	14	13	17
Uncertain	8	14	13	11	10	10

Men are strongest in their condemnation of the tax but the large majority of all groups are opposed to it.

Profits

In the May 1946 *Psychological Barometer* and again in April 1948, two questions were asked to determine people's opinions concerning the profits large companies make and the profits they should make.

Q. "Out of every *dollar* which large business companies take in, about how many *cents* do you think they keep as clear profit?"

Q. "How many cents out of every *dollar* do you think they *should keep* as a fair profit?"

	Profits Companies Keep		Profits Companies Should Keep	
	May	Apr.	May	Apr.
Cents of a Dollar	1946	1948	1946	1948
Under 10¢	13%	24%	17%	28%
10¢–29¢	29	37	42	45
30¢ and over	32	29	15	17
Uncertain	26	10	26	10

Still, the great majority have a highly exaggerated idea of company profits. Indeed, 66 per cent think these profits are from less than one to seven times as high as they actually are. The actual profit, according to Government reports, is less than 10¢ on a dollar of sales even at present high profit rates.

The Relative Standing of Various Organizations

Two different questions on people's attitudes toward various organizations were included in the April survey.

Q. "Which of the following organizations do you think well of and which not so well of?"

Organization	Total	Organization	Total
Y. M. C. A.		American Red Cross	
Well	90%	Well	72
Not so well	6	Not so well	25
Doubtful	4	Doubtful	3
Boy Scouts		Salvation Army	
Well	97	Well	89
Not so well	2	Not so well	6
Doubtful	1	Doubtful	5

The Red Cross has considerably less favor than the other three organizations.

The second of these had been asked in April 1946 and was repeated to measure trends. The results of both surveys are shown below.

Q. "Which of the following organizations do you think well of and which not so well of?"

	Apr. 1946	Apr. 1948	Change Since April 1946
The U. S. Chamber of Commerce			
Well	65%	69%	+4%
Not so well	11	8	−3
Doubtful	24	23	−1
The A. F. of L.			
Well	50		
Not so well	31		
Doubtful	19		
National Ass'n of Mfrs.			
Well	37	40	+3
Not so well	17	16	−1
Doubtful	46	44	−2
The American Legion			
Well	77	76	−1
Not so well	15	13	−2
Doubtful	8	11	+3
The C.I.O.			
Well	26		
Not so well	56		
Doubtful	18		

Explanation of the Survey

The current survey was made with 5000 interviews during April 1948; by 393 interviewers under the supervision of 150 psychologists and in 148 cities and towns. It represents a true cross-section of the urban population. Two questionnaires were used, one with half the sample, or 2500 people, the other questionnaire with the other half of the 5000 people. These two samples were comparable by geographic, sex, socio-economic, and other criteria.

Sampling Method. A modified area sampling method was used. All interviews were assigned by the local supervising psychologist by blocks and streets in accordance with maps constructed to designate the proper socio-economic levels. These maps are made to divide the population into four principal groups, the "A" group consisting primarily of owners and executives, the "B" group, primarily white-collar and semi-professional, the "C" group or skilled factory and transportation workers, "D" group or the less skilled. About 27 per cent of the sample were union members. All interviews were made in the home, but only one in a family, half were made with women, half with men.

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A Farm Knowledge Test

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In classification studies, such as practiced in prisons, courts, vocational rehabilitation agencies, etc., it is now common practice to include psychological tests which purport to evaluate the individual's aptitude and/or achievement in such broad work areas as mechanical and clerical fields. Tests of educational achievement often are included also. When the classification program is conducted among those of largely rural background, the need for some objective measure of farm knowledge becomes apparent. The present article is a report of a farm background test which was devised primarily as a part of the vocational appraisal of male adult prisoners at the Virginia State Penitentiary. The test was devised in response to a direct request from the Classification Department which pointed out the large percentage of prisoners with rural backgrounds.

Selection of Test Items

Experience had taught that most of the men on whom the test would be used came from relatively poor farm areas where general rather than specific crop farming was practiced. Studies had also demonstrated that the group on whom the test would be used would, for the most part, be poorly educated. Mental age statistics made at several different periods found the group to average dull normal intelligence, with a skew to the lower mental levels noted.

It was decided, therefore, to select only those items which would reflect a general knowledge of varied aspects of farming, but which would not sample items of a managerial nature. Since men from all sections of the State of Virginia would be included in the test population, it was decided to make the test cover as many aspects of farming as possible: crops, fruit trees, livestock, market facts, etc.

Two staff members of the State Department of Agriculture were consulted and sample items were constructed with their assistance. (This was necessary because the psychologist in the case is city bred.) Also, three experienced farmers were consulted and they were asked to list everyday farm facts which any normal farm boy should know. From these sources, over 200 items were constructed. With the assistance of the three experienced farmers, a final selection of items was made. Be-

cause the test would most often be used in group situations, the items were then written for multiple-choice style and the final format checked again by the three farmer advisers.

Description of the Test

The final test, as now used by the Virginia State Penitentiary, follows. Answers which the three farmer advisers agreed should be keyed as correct are underlined. These answers apply only to Virginia.

1. When is winter wheat sowed?
   Sept. Oct. Nov. Dec. Jan. Feb.
2. When is winter wheat harvested?
   March & April May & June June & July July & August
3. What is the average per acre yield in Virginia for wheat?
   0–10 bushels, 10–20 bushels, 20–30 bushels, 30–40 bushels
4. When is corn planted?
   Jan. thru Mar., Apr. thru June, July thru Sept.
5. What is average yield of corn per acre in Virginia?
   30–40 bushels, 50–60 bushels, 70–80 bushels, 90–100 bushels
6. When is corn harvested?
   June & July, July & August, August & September, September & October
7. When is tobacco marketed in Virginia?
   Sept thru Jan; Jan thru Apr; Apr thru Aug.
8. Hereford, Shorthorn, and Pole Angus are kinds of:
   Beef cattle, milk cows, sheep, draught horses
9. Which of the things listed below is common disease among livestock?
   Spasmosis, Black leg, Lick tongue, Ring foot
10. Which of the below is a common disease among poultry?
    Cholera, New Craw, T.B., Ring Foot
11. Which one of the crops below grows best in sandy soil?
    Corn, Wheat, Potatoes, Oats, Barley
12. Which one of the crops below grows best in clay soil?
    Corn, Wheat, Potatoes, Oats, Barley
13. At what age does an apple tree begin to bear fruit?
    1–2 Years old; 2–3 Years; 3–4 Years; 4–5 Years
14. How long will an apple tree bear if properly cared for?
    5–10 Years; 10–15 Years; 15–20 Years; 20–25 Years; 25–30 Years
15. At what age does a peach tree begin to bear fruit?
    1 Year old; 2 Years; 3 Years; 4 Years; 5 Years
16. What time of year are trees pruned?
    Jan–Feb; Mar–Apr; May–June; June–July; July–Aug; Sep–Oct.

17. What is average milking life of a dairy cow?
3–5 Years; 7–9 Years; 11–13 Years; 15–17 Years

18. What is average number of months a dairy cow can be milked each year?
4–5 months; 6–7 months; 8–9 months; 10–11 months

19. Which type of cow produces the most milk?
Jerseys; Holsteins; Guernseys; Hereford

20. Corn which has been cut up and run into a silo and permitted to ferment for feeding dairy cows is called:
Lespedeza; Ensilage; Masher-meal; Alfalfa

21. How old should a calf be before butchering for veal for human consumption?
6–9 weeks; 10–12 weeks; 13–16 weeks; 17–20 weeks

22. After being bred, how long will it take before a cow has a calf?
4 months; 5 months; 6 months; 7 months; 8 months; 9 months

23. What is daily milk yield of average cow?
1–2 gallons; 2–3 gallons; 3–4 gallons; 4–5 gallons; 5–6 gallons

24. A herd of cattle free from disease is known as:
Inspected herd; Grade A herd; Commercial herd; Stump herd

25. How much wool can you get from the average sheep at each shearing?
1–2 lbs; 3–4 lbs; 5–6 lbs; 6–7 lbs; 7–8 lbs; 8–9 lbs.

26. When are sheep sheared?
March; April; May; June; July; August; September

27. How many pigs come per litter, usually?
3–5; 6–10; 12–15; 16–18; 20–25

28. What time of year do hens lay best?
Spring; Summer; Fall; Winter

29. What time of year do fowl molt?
Spring; Summer; Fall; Winter

30. When does a dry spell hurt farming most?
Jan–Feb; Mar–Apr; May–June; July–Aug; Sept–Oct; Nov–Dec.

Statistical Results

Quite naturally, the test is able to discriminate those with farm backgrounds from those who have had no farm experience. When applied to a sample of 79 white adult prisoners of rural background and to 22 white adult prisoners of urban background, the test yielded a biserial correlation of .73. Mean score for the rural groups was 12.4, sigma 4.7. Mean score for the urban groups was 5.8, sigma 5.7.

The test does not correlate well with number of years of farm experience, however. When the product-moment correlation was computed for rural sample for score on the Farm Knowledge Test vs. number of years residence on a farm, the correlation was found to be .31 for 79 cases. Failure of the test to correlate highly with number of years of farm ex-

perience was believed at first to be because of possible correlation between intelligence and farm test score,—the hypothesis being that more alert individuals could grasp the knowledge required by the test within a relatively short time, whereas duller individuals might spend years on a farm without learning some of the knowledge required by the test. When the scores on the Farm Test were correlated with those made on the Revised Beta, a non-verbal group test of intelligence, however, the resulting correlation was insignificant: .15.

It is now believed that the test correlates poorly with years of farm experience because the facts required on the test sample breadth of farm experience rather than length of farm learning: different types of farming rather than how deeply any specific type has been practiced and mastered.

Test-retest reliability for the 79 rural cases was found to be .94 after two weeks interval.

Summary

1. A test of Farm Knowledge has been described and the need for such a test in certain classification programs has been pointed out.

2. The test does not correlate significantly with number of years of experience on the farm and this is believed to be because the test samples breadth of experience rather than depth of learning and accomplishment.

3. As was expected, the test is able to discriminate between those with rural backgrounds from those with urban backgrounds.

4. The test has proved useful in discriminating the experience range among individuals of rural backgrounds, and has been found practical in prison and pre-parole classification work.

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Creating Factor Comparison Key Scales by the Per Cent Method

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The first step in installing a plan of Factor Comparison job evaluation is to create the Key Factor Scales by means of which the jobs are evaluated. Some characteristics of the Factor Comparison method are:

1. The factor scales are created from about a dozen **Key Jobs**, selected for the purpose.

2. Not more than **Three to Six Factors** are used, not subdivided (**2, 4**).

3. The values assigned to the job factors on the factor scales are derived from **Judgments** of these key jobs, expressed by the committee members in the process of comparing one job factor with another (**1, 7**).

4. Evaluation of jobs by Factor Comparison is accomplished by **Comparing the Factors** of all jobs to be evaluated with those of the key jobs on the Factor Scales (**1, 9**).

5. Job evaluation by any method is dependent on the **Judgment** of the evaluators. In Point methods much, if not most, of the judgment is in the factors; their selection, definition, pointing, and weighing. In Factor Comparison the judgment is less in these things, and more in the comparison of factors of jobs being evaluated.

6. The **Reliability** of evaluation is increased by **Pooling** the judgments of a number of qualified and trained persons.

7. Experience shows that it is not difficult to make factor comparisons, and that the statistical **Reliability** of such estimates, reached independently by a number of judges, is consistently above .90 (**8**).

8. It has been noted that Comparison of job factors follows **Weber's Law**, in that an observable difference between job factors is expressed as a ratio of that difference to the magnitude of one of these factors. This "difference limen" has been found to be 15% (**3, 5, 6**).

The Factor Comparison method was originated by Eugene J. Benge (**1**) about 1926. His method of creating the Factor Scales makes use of the "fair and going rates" of the jobs used as key jobs. This feature of using salary or wage values as a means of deriving point values for the factors of the key jobs is not properly understood by a good many users

of other job evaluation plans. There is no doubt, however, of its entire practicability when used correctly. It has been used for all kinds of jobs, including executive ones to $50,000 a year. Nevertheless, there are situations in which it is inadvisable to rely on salary or wage values of the key jobs. This is most often for reasons of strategy or policy, such as when a joint Union-Management committee is doing the evaluation.

The Per Cent Method

To meet this situation the Per Cent Method of creating factor key scales was devised by William D. Turner (7, 10). It does not depend on salary or wage values but on an ingenious method of combining two sets of evaluators' judgments about the key jobs;

1. The magnitude of each "factor" of a job in relation to the other factors in that job, and
2. The relative magnitude of a factor in one job to the same factor in the other key jobs.

All eight characteristics of Factor Comparison job evaluation which were listed are made use of by the Per Cent Method. It is being used successfully by a management consulting organization, most recently for a salaried group of 2100 persons, so that it is in no way experimental.

A New Procedure for the Per Cent Method

The procedure described here for developing the factor scales by the Per Cent Method is shorter than the one devised by Turner (10) and gives similar results. Occasionally there is a difference of a small per cent. The new method is best understood by following the steps shown hereafter. Steps shown in Tables 1 and 2 are the same as in the original Benge method (1).

The figures in Table 1 are read from top to bottom and show the committee's opinion of the order of rank of the three jobs by factors. That is, job No. 2 is thought to require the most skill, job No. 1 the next most, and job No. 3 the least skill, and similarly for the other two factors.

Table 1

Rank of Jobs by Factor

Job No.	Skill	Decisions	Responsibility
1	2	1½	1
2	1	1½	2
3	3	3	3

In Table 2 the three factors within each job have been ranked by the committee with relation to one another (read across).

Table 2

Rank of Factors in Jobs

Job No.	Skill	Decisions	Responsibility
1	2	3	1
2	1	3	2
3	1	3	2

The rank orders of Tables 1 and 2 are now converted to percentage relationships. This is done by assuming that the job factor ranked highest in value is 100%. The group of judges then agrees on the size of the others in relation to that one, expressing their judgments as percentages of the value of the highest ranked one. For example, in Table 3 job No. 2, being ranked highest in value in Skill, is 100%; while job No. 1 is considered by the judges as being about three-quarters as much and so is placed at 75%.

Table 3

Factor % Ratings
(Read down)

Job No.	Skill	Decision	Responsibility
1	75%	100%	100%
2	100	100	85
3	50	33	25
	225	233	210

Table 4

Job % Ratings
(Read across)

Job No.	Skill	Decision	Responsibility
1	85%	40%	100% = 225
2	100	40	75 = 215
3	100	25	75 = 200

When job factors are far apart in size, they cannot be compared as accurately as when they are of nearly the same size. A familiar illustration is the attempt to judge the height of two men, one of whom is standing beside you and the other standing 100 feet away in an open space. Gross differences are noticeable at a distance but not small ones. Ac-

curacy in estimating the *size* of differences is less than if the two men, or other objects being judged, are side by side. No attempt has yet been made to determine experimentally the accuracy with which job factors of widely differing difficulty values can be estimated. If traditionally the job with the highest difficulty value in a group of jobs is about four times the lowest one, it can be presumed that differences between factors of such jobs will not be much more. This is a useful guide in estimating the probable range of factor values from high to low. In view of the relevancy of Weber's Law, it is obvious that observable per cent differences between job factors must necessarily be about 15%.

Tables 5 and 6 are the same as Tables 2 and 4, except that all values have been shrunk so that totals will add to 100.

Table 5

F% Values
(Read down)

Job No.	Skill	Decision	Responsibility
1	33	43	48
2	45	43	40
3	22	14	12
	100	100	100

Table 6

J% Values
(Read across)

Job No.	Skill	Decision	Responsibility
1	38	17	45 = 100
2	46	19	35 = 100
3	50	12	38 = 100

Table 7 is constructed by dividing each cell of Table 5 by the corresponding cell of Table 6. This operation is the key to the Per Cent Method, because by it the relative total values of the jobs are determined. In fact, two sets of total job values may be extracted from Table 7:

1. The totals of the rows of Table 7 give the relative job value totals derived from one set of committee judgments; namely, the percentages of all factors to their jobs as in Table 6.

2. The reciprocals of the totals of the columns give the relative factor value totals which were derived from the other set of committee judgments; namely the percentages of job factors to the total value of each of the three factors in Table 5.

Table 7
F%/J% Ratios

Job No.	Skill	Decisions	Responsibility		Totals
1	.87	2.53	1.07	=	4.47
2	.98	2.26	1.14	=	4.38
3	.44	1.17	.31	=	1.92
	2.29	5.58	2.52	=	10.77
Reciprocals	.437	.168	.397		1.002
Reciprocals, adjusted	.470	.180	.426		1.077

Begin Table 8 by copying from Table 7 the row (job) totals. Distribute these totals among the factors in the same percentages chosen by the evaluating committee in Table 6. In performing this operation, multiply each value by 100, in order to avoid using decimals. *Any* multiplier would do, because the job totals whould still be *relatively* the same.

Table 8
Totals Distributed Per Tables 5 and 5 × 100 and × 1000

	Skill		Decisions		Responsibility		
Job No.	F	J	F	J	F	J	
1	155	170	77	76	205	201	= 447
2	210	195	77	87	170	153	= 438
3	105	96	26	23	51	73	= 192
	470		180		427		= 1077

Next, take the reciprocals of the factor column totals from Table 7, multiplied by 1000, and by the fraction 1077/1002, so that the grand total of the row (job) totals in Table 8 will be the same as the grand total of the column (factor) totals—1077. This step is essential to permit direct comparison of the two sets of committee judgments, which otherwise would not be to the same scale. Now enter them in the corresponding positions in Table 8. Distribute each of these three column totals among the jobs in the proper column according to the percentages originally selected by the committee and shown in Table 5. Table 8 now contains two sets of values of each factor of each job; one set derived from the opinions of the committee as to the size of each factor of each job in rela-

tion to the other factors in the job; and the other derived from the opinions of the committee as to the size of each factor of each job in relation to the size of the same factor in the other jobs. Any differences between pairs of values in Table 8 are the result of variation in the two sets of opinions of the committee. It is now the problem of the committee of evaluators to decide what value to use, when there is a difference between the two. In cells 1-D and 1-R the differences are under 2%; in cells I-S, 2-S, and 3-S, the differences are less than 10% of the larger value; and in cells 2-D, 2-R and 3-D the differences are between 10% and 12%. In only one cell is there a larger difference; 30% in cell 3-R.

Application of Weber's Law to the Key Scales

Experimental work (3, 5, 6) has shown that the "difference limen" or threshold of perception of differences in Factor Comparison job evaluation is 15%. Differences of this magnitude can be perceived about 75 of the time by an experienced committee composed of qualified and well-trained individuals (8). It follows that there is no point in using evaluating scales which provide finer distinctions than about 15%. It is in order, therefore, to adjust the values in Table 8 to conform with differences of 15%. It is convenient to use 100 as a base, particularly since 100 was the base for the per cent judgments of Tables 3 and 4. Table 9 gives 15% intervals from 100.

Table 9

15% Intervals Based on 100

200	100	50	25	12
174	87	43	22	10
152	76	38	19	9
132	66	33	16	8
115	57	29	14	7

The values have been rounded. It will be noticed that they double every five steps, a convenience in evaluation work. In deciding what values to use for the final factor scales there are three logical choices:

1. Adopt the factor value derived from the row (job) totals.
2. Take those derived from the column (factor) totals.
3. Use the average of the row and column factor values.

Experimentally and logically the column relations of Table 5 (job to job by factor) are more objective and therefore more validly and reliably judged than the row (factor to factor by job) relations of Table 6. The latter set of relationships seems to evaluators to be somewhat artificial. Table 10 shows the final factor scales which can now be used for evaluat-

ing all other jobs. In the illustration used here there are only three jobs, for convenience and simplicity. In actual situations there would be from 10 to 20 key jobs.

Table 10
Factor Scales

Factor Values (15% Intervals)	Skill	Decisions	Responsibility
230			
200	Job No. 2		Job No. 1
174			Job No. 2
152	Job No. 1		
132			
115			
100	Job No. 3		
87			
76		Job No. 1 and No. 2	
66			Job No. 3
57			
50			
43			
38			
33			
29			
25		Job No. 3	
22			

Proof That Row Totals Correspond With Job Totals

Let S_t be the sum total of skill of all jobs.
D_t and R_t are respectively the Decisions and Responsibility of all jobs.
S_a is the skill of job a.
J_a is the value of job a and $= S_a + D_a + R_a$.
J_t is the total value of all jobs and $= S_t + D_t + R_t$
$= J_a + J_b + J_c + \cdots J_n$.

1. Each cell of the first column of Table 5 is an F% and is $\frac{S_{a\cdots b\cdots c\cdots n}}{S_t}$.

2. Each cell of the first column of Table 6 is a J% and is $\frac{S_{a\cdots b\cdots c\cdots n}}{J_{a\cdots b\cdots c\cdots n}}$.

3. Table 7 is $F\%/J\% = \frac{S_a/S_t}{S_a/J_a} = \frac{S_a}{S_t} \times \frac{J_a}{S_a} = \frac{J_a}{S_t}$ in row 1, col. 1.

4. Add horizontal values, $\frac{J_a}{S_t} + \frac{J_a}{D_t} + \frac{J_a}{R_t}$, for the first row.

5. This fraction can be reduced to the form, $J_a \frac{(D_tR_t + S_tR_t + S_tD_t)}{S_tD_tR_t}$.
6. If these row totals are now added, the grand total at the foot of the column is, substituting X for the fraction in 5 above,

$$J_aX + J_bX + J_cX + \cdots J_nX = J_tX.$$

The value of the fraction, "X," may be cancelled from both sides of the equation. The result is

7. $J_a + J_b + J_c + \cdots J_n = J_t$, which is true by definition.

Proof That Reciprocals of Column Totals Correspond With Factor Totals

In dealing with the correct relation between the factors, it is necessary to use the reciprocals of the totals of the columns for Skill, Decisions and Responsibility as will be apparent from the following steps, which follow after step 3 of the proof relating to the horizontal (job) values:

4. If the values in the first column of cells (the Skill column) are added, the result is $\frac{J_a}{S_t} + \frac{J_b}{S_t} + \frac{J_c}{S_t} \cdots \frac{J_n}{S_t}$.
5. But $J_a + J_b + J_c + \cdots J_n = J_t$.
6. Therefore the fraction in 4 equals $\frac{J_t}{S_t}$.
7. The reciprocal of this final fraction is, of course, $\frac{S_t}{J_t}$.
8. The reciprocals of the totals of the Decisions and Responsibility columns will similarly be, respectively, $\frac{D_t}{J_t}$ and $\frac{R_t}{J_t}$.
9. If these three column totals are added the result will be

$$\frac{S_t}{J_t} + \frac{D_t}{J_t} + \frac{R_t}{J_t} = \frac{S_t + D_t + R_t}{J_t}.$$

10. But, by definition, $S_t + D_t + R_t = J_t$.
11. So, the fraction in step 9, which is $\frac{S_t + D_t + R_t}{J_t}$, can also be written $S_t + D_t + R_t = J_t$.

Summary

Best methods of job evaluation rest on factor scales which are used to evaluate jobs by comparison. Point methods use a priori scales and Factor Comparison methods use scales developed for each installation by an evaluating committee. The original Benge method of evaluation, which has since become known as Factor Comparison, uses scales de-

veloped by judgments of the committee members applied to a few "key jobs," values for which are derived from the going wage or salary rates of the key jobs. Another way of developing the key factor scales is known as the Per Cent Method, which does not make use of money values. A new and short version of the Per Cent Method is described here, which should have application whenever policy or strategy forbids the use of money values for key jobs. It is particularly applicable to high-salaried positions; those from about $5000 to $50,000 or more. Its successful use depends on two things; (1) Careful selection of the evaluating group, preferably with psychological aids, and (2) Sound and thorough training of the evaluators, having in mind at all times the principles of psychological measurement.

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Reliability and Comparability of Different Job Evaluation Systems *

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The purpose of this investigation was twofold: (1) To study the reliability of a job evaluation manual as determined by a comparison of ratings made by independent raters evaluating the same jobs; and (2), to determine the degree to which different types of job evaluation systems give the same results. These two problems are treated together in one report, rather than separately, because the experimental procedures followed for both problems were so closely related, and because the results of either problem have greater meaning when compared with those of the other.

Previous Research on Reliability in Job Evaluation. The problem of reliability in job evaluation is relatively simple from the viewpoint of experimental design, but difficult to attack practically because of the inconveniences involved in obtaining the services of experienced job evaluators in industry to act as raters. It is probably for this reason that very little research has been done on the problem.

Lawshe (3) presents some data concerning reliability. The same group of raters rated the same five jobs on three different occasions. The smallest fluctuation for any one job was 25 points and the greatest fluctuation was 100 points; the average fluctuation was 71 points. In

* A condensation of a portion of a Ph.D. thesis submitted to the Graduate School of Western Reserve University in 1948. The writer is greatly indebted to Jay L. Otis, Director of the Personnel Research Institute of Western Reserve University, for direction and encouragement in this study. This study would have been impossible without the efforts of certain individuals engaged in job evaluation work in several organizations in Cleveland, Ohio. That these individuals found time in the midst of busy schedules to perform the arduous task of rating a group of jobs according to one or more job evaluation systems is a tribute to them and to the organizations with which they are affiliated. A special debt of thanks, therefore, is due to: Richard H. Rice, American Greeting Publishers, Incorporated; Arthur S. Hann, Central National Bank of Cleveland; Clyde L. Lerner and Frederick W. Becker, Cleveland Electric Illuminating Company; George H. Thobaben, Cleveland Graphite Bronze Company; Norman B. Bradley and Charles A. Husak, East Ohio Gas Company; Elwood V. Denton, Federal Reserve Bank of Cleveland; Clark C. Sorenson and Richard C. Hoff, Harris-Seybold Company; Joseph J. Scherban, National Screw and Manufacturing Company; Sterling T. Apthorp, Wayne R. Flight, and Frederick A. Castle, Standard Oil Company of Ohio; and Madeline L. Longenecker, Warner and Swasey Company.

terms of cents per hour this was equivalent to a low of $.02 and a high of $.10, with an average of $.05.

In a later study Lawshe and Wilson (5) made a comparison of the reliabilities of a long and an abbreviated scale. This study involved 40 jobs and 20 job analysts. Each analyst rated 20 of the 40 jobs, although no two raters rated the same 20 jobs either under the long or the short system. However, each consecutive pair of judges, between them, rated all 40 jobs and were treated statistically as "one man." Under these conditions reliabilities of .77 for the long system and of .89 for the short system were obtained. Application of the Spearman-Brown formula to obtain an estimate of the correlation between the "pooled ratings" of two groups of 5 judges each yielded correlations of .94 and .98 for the long and short systems respectively.

Ash (1) recently made a study of factor reliability in which various job analysts *ranked* a group of jobs for each of nine factors. The correlations between the rankings of each analyst on each factor and the "median array" for each factor ranged from .25 to .98.

It would seem that in studying reliability, job evaluators should follow the methods generally followed in experimental and industrial psychology. This would mean that there would be two approaches to the problem. One of these might be called the rate-rerate method, which would be analogous to the "test-retest" method in psychological testing. The other method involves a comparison of the results of independent raters or groups of raters in making the original ratings. In both of these methods it is desirable that the same jobs be rated by all the analysts or groups of analysts participating. It seems desirable also that one report simple straightforward product moment correlations between point ratings assigned either by the same individual or groups on two different occasions, or by different individuals or groups operating independently.

Previous Research on Comparability of Different Job Evaluation Systems. Very few, if any, published studies can be found which report direct comparisons of two or more job evaluation systems, although various authors do not hesitate to cite the advantages of and imply greater validity in various types of system. Viteles (6) recognized this situation, and stated it well: ". . . certain of the issues can be so easily settled by a direct comparison, under controlled conditions, of results. . . . Such a comparison would give valuable information of the time taken to obtain such results, of the effort and money expended, and of the reliability, validity, and usefulness of the final product. However, in spite of one or two essays in this direction, definitive experiments still remain to be made."

Otis and Leukart (5) have indicated the method to be followed in

determining the differences among results obtained with different systems: "To date there has not been enough research on the application of different methods of job evaluation to the same jobs. Such comparisons should be made to determine if approximately the same classifications would be obtained when the same jobs are evaluated by different methods."

As may be inferred from the foregoing, one of the objectives of the present study was to make a direct comparison of different job evaluation systems in use in several organizations.

Method

The essential feature in the methodology of the present study was to keep certain variables constant under certain conditions. In job evaluation the variables are the jobs, the raters, and the job evaluation manuals. In the present study, the jobs were constant throughout, and are referred to as the "standard jobs." Another constant in certain parts of the study was a point rating type of job evaluation manual, referred to as the "standard manual," to distinguish it from the various manuals actually in use in the organizations which participated. And finally, certain comparisons have been made in which the raters were kept constant.

The experimental procedure was comparatively simple. In essence, job analysts on the staffs of several industrial and commercial organizations were asked to rate a set of standard jobs on the standard manual and on their own company manuals.

The Standard Jobs. Job descriptions and specifications for 35 clerical, administrative, and supervisory jobs were taken from the files of a large commercial organization. The standard jobs, therefore, were jobs that actually existed in a going organization; they were not hypothetical or "ideal" jobs devised for the experiment. The job descriptions and specifications were taken practically intact, and only very minor modifications and revisions were made for the purpose of disguising the identity of the organization in which the jobs existed. A few minor editing changes were made to clarify duties or specifications of some of the jobs.

The 35 standard jobs were identified by number and name as follows: 1. Addressograph operator; 2. Assistant auditor; 3. Assistant personnel manager; 4. Assistant purchasing agent; 5. Bookkeeping machine operator; 6. Building manager; 7. Building office stenographer; 8. Chief telephone operator; 9. Employment interviewer and women's counsellor; 10. Expense accounting paying clerk; 11. Expense accounting report clerk; 12. Expense audit clerk; 13. Head of payroll division; 14. Key punch operator; 15. Mail department clerk-typist; 16. Messenger; 17. Payroll clerk; 18. Payroll clerk-typist; 19. Payroll record clerk; 20.

Personnel clerk; 21. Personnel clerk-typist; 22. Photostat machine operator; 23. Recordak operator; 24. Registered nurse; 25. Secretary to auditor; 26. Senior general files clerk; 27. Senior IBM clerk; 28. Senior mail clerk; 29. Senior multigraph operator; 30. Sorting machine operator; 31. Stockkeeper and receiving clerk; 32. Supervisor of tabulating; 33. Tabulating machine operator; 34. Telephone operator; and 35. Teletype operator.

These particular jobs were selected because they represent a wide range of job difficulty and because they are typical of salaried jobs in many industrial and commercial organizations. The company in which these jobs existed had approximately 500 job classifications and a wage plan with 15 labor grades. The 35 standard jobs were distributed in labor grades 1 to 14 as shown in Table 1.

Table 1

Distribution of 35 Standard Jobs According to Labor Grade

	Labor Grade														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
No. of Jobs	1	1	1	5	6	4	4	4	3	1	1	2	1	1	35

It was the feeling of the chief job analyst in the organization from which the job descriptions were taken that this distribution was typical of the distribution of all the jobs in this organization.

The job specification for each standard job was divided into 12 categories in order to key in with the 12 rating scale items of the standard manual described below.

The Standard Manual. The standard manual was a fairly typical point rating manual with 12 factors.[1] The 12 factors are listed in Table 2. The first column indicates the relative percentage points for or numerical weight of each factor. These weights were arrived at as the result of two years of work in the Personnel Research Institute of Western Reserve University with factors identical or similar to those listed above. The weights represent the concensus of dozens of individuals with varying amounts and types of personnel experience.

Participating Companies. A total of nine independent private industrial firms participated in this study. In this report these companies are referred to as Co. A, Co. B, etc. These code letters were assigned to the companies in the order in which they submitted any raw data.

[1] This manual was the most recent form of a manual which had gone through several stages of development in the Personnel Research Institute of Western Reserve University. It was very much like the manual in use in the organization which contributed the standard jobs.

Table 2

Point Values Assigned to Each Degree of Standard Manual Factors

Item	Level					
	1	2	3	4	5	6
1. Work experience	21	38	55	71	88	105
2. Essential knowledge and training	17	31	44	58	71	85
3. Dexterity	4	9	15	20		
4. Character of supervision received	10	20	30	40	50	
5. Character of supervision given	11	22	33	44	55	
6. Number supervised	7	13	18	24	29	35
7. Responsibility for funds, securities, and other valuables	6	11	16	20	25	30
8. Responsibility for confidential matters	6	18	30			
9. Responsibility for getting along with others	6	14	22	30		
10. Responsibility for accuracy—effect of errors	6	12	18	24	30	
11. Pressure of work	4	9	15	20		
12. Unusual working conditions	2	6	10			

The Raters. The number of raters in each company ranged from one to three. All of the raters were well trained and experienced job analysts who devoted most of their time in their respective organizations to job evaluation work.

The Company Job Evaluation Manuals. In addition to rating the standard jobs on the standard manual, raters in six of the nine companies also rated the jobs on their own company manuals. A brief description of each of these company manuals follows:

Co. A—A factor comparison system practically identical to that presented by Benge, Burk, and Hay (2). This system contains five factors: (1) Mental effort; (2) Skill; (3) Physical effort; (4) Responsibility; and (5) Working conditions.

Co. B—A point rating system with 15 factors.

Co. C—A factor comparison system similar in all respects to the system of Co. A, except for one factor, "supervision," which was present in place of "working conditions."

Co. F—A point rating system with 13 factors.

Co. G—A point rating system with 15 factors.

Co. I—This company had no formal job evaluation plan as such, but its system might be described as a combination ranking and grade classification method. The jobs in this company were classified into established labor grades. Any new job that was created was

compared with similar jobs already classified to determine the particular labor grade in which it should fall. It was then given a rank within the labor grade and a salary assigned to it somewhere between the salaries of the job above it and the job below it.

Experimental Procedure. Job analysts in each company were asked to rate the 35 standard jobs on the standard manual and on their own company manuals. The specific instructions to the raters were as follows: "1. Rate the 35 standard jobs on the standard manual. Rate the jobs as described, not as such jobs may happen to exist in your organization." "2. Rate the 35 standard jobs on your company manual. Again, rate the jobs as they are described, not as such jobs may happen to exist in your organization."

The raters were not informed of the point values assigned to the factors and degree levels for the standard manual. This was done in order to control as much as possible the bias which might operate if the factor weights were known.

The raters were cautioned to do step 2 of the instructions as independently of step 1 as possible; in other words, they were told not to allow their judgment while using the standard manual to influence their judgment while using their own company manuals. As a matter of fact, of the six companies which completed step 2, four completed step 1 and submitted the data before beginning step 2.

One minor problem which it was felt might present itself in rating the standard jobs on the company manuals was the fact that the job specifications were expressed in terms of the factors which comprised the standard manual. However, all of the raters reported that they had no difficulty in rating the standard jobs on their own manuals. The reason for this is probably the fact that the job descriptions were very detailed and thorough.

The total point values for the standard jobs, both on the standard manual and the various company manuals, together with the point values for individual factors in the standard manual constituted the raw data for the present study.

Results and Interpretation

Reliability of the Standard Manual. Data from the first seven companies in which job analysts rated the standard jobs on the standard manual were utilized for determining reliability of the manual. Table 3 shows the product moment intercorrelations among these job analysts. These reliability coefficients range from .93 to .99 with an average of .97. These coefficients seem unusually high, but upon further consideration the results are not unexpected. In the opinion of the writer, the key to

the magnitude of these coefficients lies in the thoroughness and detailed nature of the job descriptions and specifications of the standard jobs. The data in Table 3 indicate the degree of reliability, as measured by the correlation coefficient, that can be attained with a carefully constructed job evaluation manual, thorough and detailed job analyses, and experienced job evaluators.

Table 3

Reliability of the Standard Manual: Intercorrelations of Raters in Seven Companies Who Rated the Same Jobs on the Same Job Evaluation Manual

	Co. A	Co. B	Co. C	Co. D	Co. E	Co. F	Co. G
Co. A		.95	.98	.98	.95	.97	.99
Co. B	.95		.96	.95	.93	.95	.95
Co. C	.98	.96		.98	.96	.99	.99
Co. D	.98	.95	.98		.96	.98	.98
Co. E	.95	.93	.96	.96		.96	.95
Co. F	.97	.95	.99	.98	.96		.97
Co. G	.99	.95	.99	.98	.95	.97	

The correlation coefficient is only one index of reliability. Another, and perhaps more practical, index is the range of fluctuation of point ratings for each job among the seven different raters. For the 35 standard jobs the fluctuations in point ratings ranged from 9 to 106 points with an average of 37.9 points. The fluctuations in point ratings may be analyzed in terms of labor grades, as shown in Table 4, which is based upon equal labor grades of 25 points each. The fluctuation among seven sets of ratings of 35 jobs was the value of 1.0 labor grade (25 points) or

Table 4

Fluctuations in Terms of Labor Grades Among Seven Raters Who Rated the Same 35 Jobs on the Same Job Evaluation Manual

Labor Grade Fluctuations	*f*	%	Cum. %
0–0.5	1	2.9	2.9
.51–1.0	6	17.1	20.0
1.01–1.5	13	37.1	57.1
1.51–2.0	10	28.5	85.6
2.01–2.5	2	5.7	91.3
2.51–3.0	1	2.9	94.2
3.01–3.5	1	2.9	97.1
3.51–4.0	0	0	97.1
4.01–4.5	1	2.9	100.0

Table 5

Correlations Between Each Factor of Standard Manual and Total Score on Standard Manual for 35 Standard Jobs

Factor	Co. A	Co. B	Co. C	Range
1. Work experience	.89	.90	.89	.01
2. Essential knowledge and training	.76	.70	.77	.07
3. Dexterity	−.06	−.19	−.11	.13
4. Character of supervision received	.85	.81	.90	.09
5 Character of supervision given	.81	.82	.83	.02
6. Number supervised	.72	.72	.77	.05
7. Responsibility for funds, securities, and other valuables	.23	.21	.31	.10
8. Responsibility for confidential matters	.68	.70	.57	.13
9. Responsibility for getting along with others	.64	.63	.64	.01
10. Responsibility for accuracy—effect of errors	.78	.65	.76	.13
11. Pressure of work	.06	.49	.52	.46
12. Unusual working conditions	−.25	−.30	−.26	.05

less for 20 per cent of the jobs, and the value of 1.5 labor grades (37.5 points) or less for 57.1 per cent of the jobs. It is difficult to form a judgment as to whether these results are "good" or "not so good," in view of the paucity of previous research on the problem. The findings do emphasize, however, the different impressions of reliability that may be obtained from correlation coefficients and from fluctuations among raters.

Relationship Between Each Factor of Standard Manual and Total Score. The data from three of the participating companies were analyzed to determine the relationship between each factor of the standard manual and total score on the standard manual. Table 5 shows the correlations between each factor and total score and the range of these correlations for each factor. It is believed that the magnitude of the range is an indication of the reliability of each factor. The ranges in Table 5 vary from .01 for "work experience" to .46 for "pressure of work." However, disregarding the latter would give a variability of .01 to .13.

The relatively high range for "pressure of work" would seem to indicate that there was a difference in interpretation of this factor between Co. A on the one hand and companies B and C on the other.

The negative correlations for "unusual working conditions" and "dexterity" indicate that for salaried jobs in general jobs with better working conditions and requiring less manual dexterity are paid better wages than jobs with poor working conditions and requiring more manual dexterity.

Comparison of Company Job Evaluation Manuals. The product moment intercorrelations of six company manuals as used by raters or groups of raters in each company to evaluate the standard jobs are shown in Table 6. These correlations range from .89 to .97 with a mean of .94.

Table 6

Intercorrelations of Six Different Company Manuals Used to Rate 35 Standard Jobs

	Co. A	Co. B	Co. C	Co. F	Co. G	Co. I
Co. A		.91	.97	.95	.95	.89
Co. B	.91		.95	.94	.94	.91
Co. C	.97	.95		.95	.97	.93
Co. F	.95	.94	.95		.95	.89
Co. G	.95	.94	.97	.95		.94
Co. I	.89	.91	.93	.89	.94	

They are almost as high as the reliability coefficients reported in Table 3 for the standard manual, and indicate that various types of job evaluation systems classify jobs very much the same.

As in the case of the reliability coefficients discussed above, the high correlations among the different company manuals are probably due primarily to the thoroughness and detail of the standard job descriptions and specifications, although here again, the competence of the job evaluators who participated undoubtedly contributed.

The practical import of these findings is that the particular type of system used in an organization is not nearly so important as the integrity and accuracy with which it is installed, policed, and maintained. If most systems yield generally the same results, obviously the problem of deciding upon a system to adopt boils down to questions of time, ease of understanding on the part of all individuals concerned, and ease of installation and maintenance.

Comparison of the Standard Manual and the Company Manuals. The correlations between the standard manual and the company manual in each of six companies were as follows: Co. A, .91; Co. B, .88; Co. C, .95; Co. F, .90; Co. G, .95; Co. I, .99.

The range and magnitudes of these correlations are very much in line with those reported above among different company manuals. Since the standard manual may be thought of as "another company manual" which was tried out in several places on a set of standard jobs along with other company manuals, these findings with respect to range and magnitude of correlation coefficients were expected. If the correlations above had been lower than those reported in Table 6, then there would have been reason to believe that there was something unusual about the standard manual.

Specifically this would mean that there was comparatively less commonalty between the standard manual on the one hand and the company manuals on the other. However, the results indicate that this was not the case.

Summary and Conclusions

1. The basic methodological feature of the study was to have raters in various companies evaluate a standard set of job descriptions and specifications for 35 representative salaried jobs on a standard job evaluation manual and on their own respective company manuals. The standard manual was of the point-rating type and contained 12 factors.

2. The reliability of the standard manual was determined by comparing the results of independent raters in making original ratings. Inter-rater correlation coefficients ranged from .93 to .99 with an average of .97. The high order of these coefficients was ascribed primarily to the thorough and detailed nature of the job descriptions and specifications. For the 35 jobs, fluctuations among seven raters ranged from 9 to 106 points with an average of 37.9 points. The fluctuations among the seven sets of ratings was equal to the point value of 1.0 labor grade or less for 20 per cent of the jobs, and equal to the point value of 1.5 labor grades or less for 57.1 per cent of the jobs.

3. Correlations between each factor of the standard manual and total score on the standard manual were computed from data submitted by three companies. Except for one factor, there was a high degree of similarity among the three correlations thus computed for each factor, suggesting high factor reliability. Negative correlations were obtained between total score on the standard manual and the factors, "unusual working conditions" and "dexterity," indicating that salaried jobs with better working conditions and requiring less manual dexterity tend to be paid higher wages than salaried jobs with poor working conditions and requiring more manual dexterity.

4. Intercorrelations among six different company job evaluation systems ranged from .89 to .97 with a mean of .94. These six systems included two factor comparison systems with 5 factors each, two point rating systems with 15 factors each, one point rating system with 13 factors, and one ranking system. The results indicate a high degree of commonalty among different job evaluation systems.

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Industrial Noise and Hearing

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Industrial noise has increased steadily with growth in mechanization. As an undesirable feature of the industrial environment, noise today is of increasing conern to many groups. There is some evidence that in the industrial situation noise is a contributing factor to inefficiency, fatigue, lowered morale, absenteeism, accidents, and labor turnover. Probably, however, the most incontestable evidence is that industrial noise contributes to deafness. It is the purpose of this article to summarize certain published studies on the relation of noise to impairment of hearing, and to note the possible implications of the findings from the standpoint of compensation for the resultant disability.

Generally conceded to mean any unwanted sound, noise has been rather thoroughly studied. In order to study noise and its effect, it is necessary to measure it. Its accurate measurement, i.e., determination of its intensity and composition, is now possible. Intensity is most often measured by a sound-level meter. This is an instrument having a microphone which is placed in the noise field. The resultant electrical current output of the microphone is then indicated on a calibrated decibel scale. The intensity is usually expressed in terms of the decibel, a unit which may have its zero point standardized at approximately the least sound that can be heard by the "normal" ear. The composition of a noise is essentially determined by an analyzer which indicates the intensity of the frequency components of the complex sound. Dependable noise measurement is not a simple process and usually requires the services of a skilled acoustic technician.

Hearing, related as it is to noise and being an integral part of the health of the industrial worker, must be precisely and accurately measured. An instrument designed to do this measuring of a person's auditory acuity is the audiometer. Important in making adequate hearing measurements, in addition to the audiometer, are a sound-proofed testing room, or at least a room in which the ambient noise is low and stable, and the services of suitably trained technicians.

Noise and hearing measurement, although requiring some equipment and trained personnel, is not very expensive and may be highly desirable, especially in "noisy" industries.

Noise and Production

Several surveys and experiments, e.g. (**27**, **34**, **46**), have tended to substantiate the belief that noise contributes to inefficiency and reduced productivity. Although there is a dearth of dependable "before and after" production figures available, the bulk of extant evidence shows noise to be deleterious to production. The studies that have been made assume significance in the accumulation of facts which indicate that even workers who are accustomed to working under noisy conditions still show increase in production when noise is reduced. Kerr (**25**) and Poffenberger (**36**), however, have reported that music may in some cases increase production. It appears, then, that some carefully controlled research is needed to ascertain the exact relation of noise to attention and this in turn to efficiency.

Indirect Effect of Noise on Workers

In addition to the direct effect of noise upon workers as evidenced by production, the indirect influence may be of "dollars and cents" value to industrial management. What is the possible contributory influence of noise to employee morale, absenteeism, labor turnover, accident rate, etc.? In some of the pertinent reports found in the literature (**3**, **6**, **7**, **40**) there is extensive evidence that noise tends to influence these factors adversely. Most often reported in the employees' responses to noise reduction is the increased "ease of talking" which, it might be readily agreed, improves the attitudinal outlook of the employee and increases his overall satisfaction.

Noise and Deafness

The most convincing argument for reduction of noise in industry is the effect of noise on hearing. The literature dealing with the relation of auditory stimulation by industrial noise to hearing extends back at least as far as Fosbrooke's article (**15**) Pathology and Treatment of Deafness, published in 1831, in which he called attention to the prevalent deafness in blacksmiths. A thorough résumé and discussion of the early literature on the influence of industrial noises, previous to 1914, can be found in an article by Gilbert (**17**). Another rather complete account bearing directly on the deafness problem is A Critical Review of Experiments on the Problem of Stimulation Deafness, published in 1935 by Kemp (**24**). In 1946, Berrien (**2**) published a general review, under the title of The Effects of Noise, covering such aspects as effects on production, influence on vital processes, adaptation to noise, etc.,

Recent Studies. Among the more recent studies on noise relevant to hearing in industry is a rather comprehensive one reported by Gardner

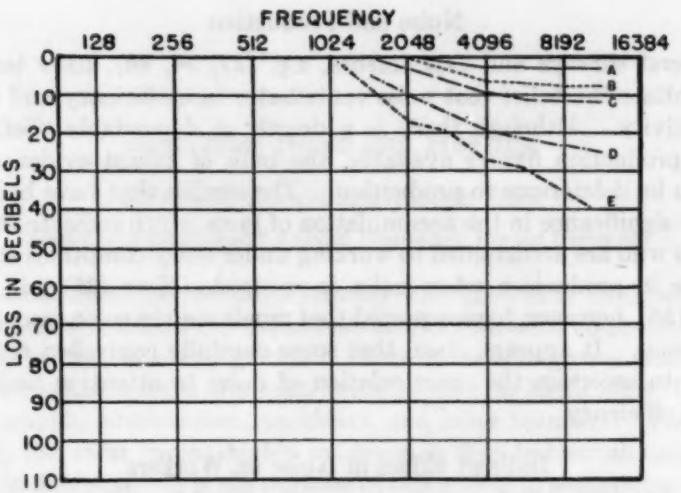

FIG. 1. Normal decrease in hearing acuity with increasing age. From Gardner (16): A = 10–19 years; B = 20–29 years; C = 30–39 years; D = 40–49 years; and E = 50–59 years.

(16) in which the hearing of shipyard workers was tested and the results compared with other groups.

In Figure 1 is shown an audiogram (a graphic record of auditory sensitivity) of the normal decrease in hearing acuity with increasing age.

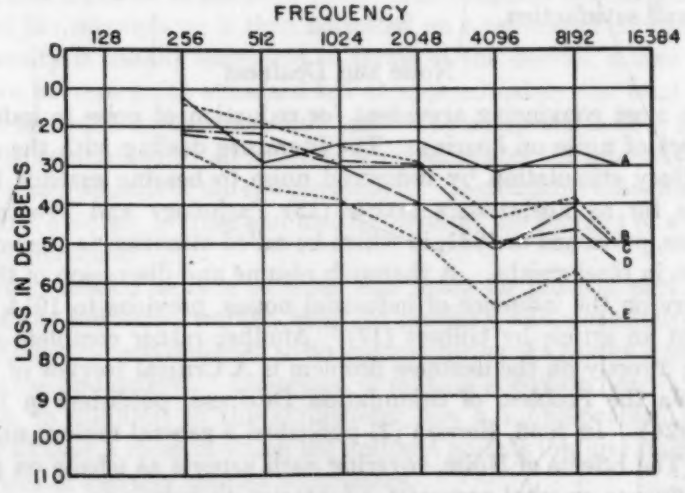

FIG. 2. Average hearing loss of 296 shipyard workers according to age. From Gardner (16): A = 16–20 years (N = 28); B = 21–30 years (N = 92); C = 31–40 years (N = 120); D = 41–50 years (N = 44); E = 51–65 years (N = 12).

This variation of hearing with age is a natural phenomenon which should not be discounted when considering apparent hearing losses of adults. Gross discrepancies between the curves shown in Figure 1 and various subsequent audiograms indicate that some unnatural element is causative of hearing loss.

Figure 2 displays the principal data obtained by Gardner (16) and may be compared with Figure 1 so that the magnitude of hearing loss, with attention given to age, will be apparent for those workers who represent the shipyard working group.

Another study on the relationship between noise level of the working environment and deafness was made by Rosenblith (38). Because of the

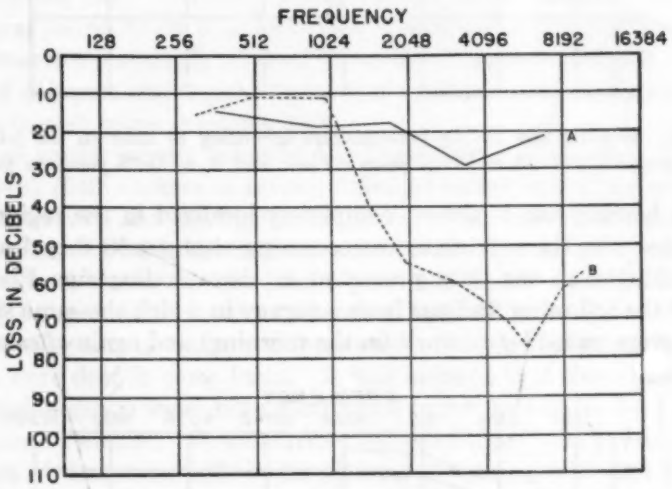

FIG. 3. Comparison between "normal" and industrial hearing loss. From Rosenblith (38): A = AWorld's Fair Group, 40–49 years; and B = Boilermakers, average age 45 years.

high noise-level encountered in a boiler factory (about 110 decibels average) (1), the main data were gathered there. In Figures 3, 4, and 5 these audiograms indicate clearly the damaging effect on hearing resulting from working in a noisy environment. Figure 3 specifically compares the hearing loss among boilermakers to a group of "normals" (as measured by the Bell Telephone Laboratories at the 1939 World's Fair). It is particularly important to note that the groups shown are for all intents and purposes equated on the age factor. Figure 4 shows the degree of hearing loss of workers relative to their tenure on the job. Figure 5 makes possible visualization by the reader of the relationship between the average noise level and the hearing losses. In addition, this figure shows

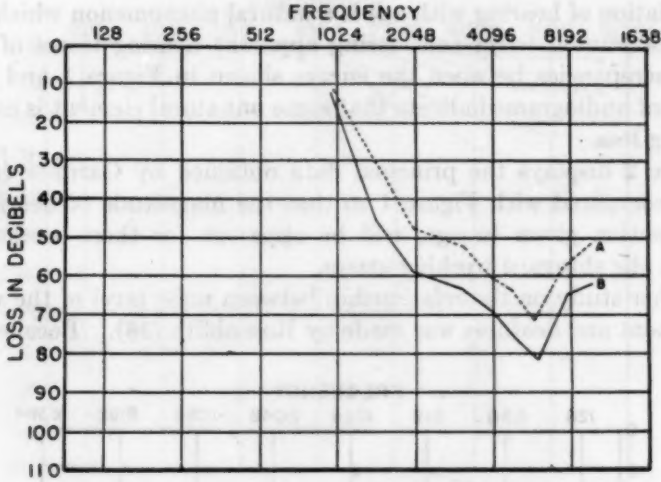

FIG. 4. Hearing loss among boilermakers according to time on the job. From Rosenblith (38): A = 15–20 years on job; and B = 20–25 years on job.

how the hearing loss is almost completely localized in the region above 1000 cycles with the maximum loss occurring at about 6000 cycles.

In addition to the data presented in these audiograms Rosenblith reported the following findings from a survey in which the same shipyard workers were tested *before* work (in the morning) and again *after* work (in

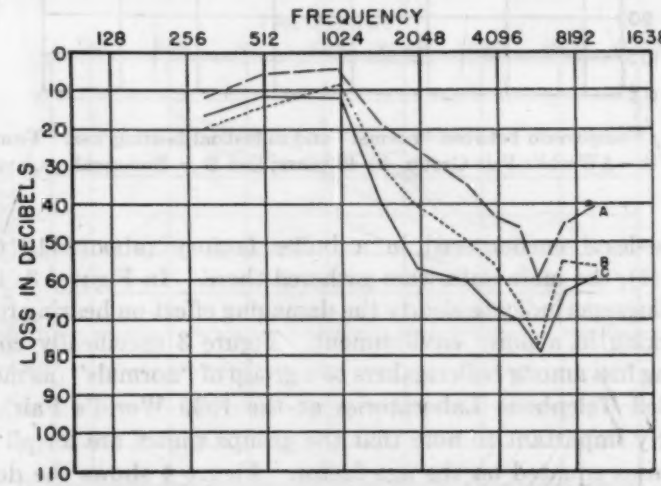

FIG. 5. Hearing loss among various categories of personnel after 15 years of employment in a boiler factory. From Rosenblith (38): A = Machinists (average noise level 75db); B = Blacksmiths (average noise level 80db); and C = Boilermakers (average noise level 90 db).

the evening): 75% showed greater hearing loss in the evenings; 19% were the same morning and evening; and 6% were better in the evening. These percentages point out at least a temporary loss of hearing which may be directly attributable to the high noise level found in this occupation.

McCoy (**32**) reports on a study in which 100 preemployment audiometric tests were made on men going into noisy occupations at a large shipyard. These individuals gave no past history of exposure to noise, or disease of ear, nose, or throat. It was found that after working 7 hours at the task of chipping (110 to 130 decibels) a representative group of men had a distinct loss in hearing. This decrement was also discernible the following day. Further, McCoy reports, after a period of one month there was found to be a definite loss of hearing in the high frequencies which was not materially affected by a rest of one or two days. Examination of chippers after a year or more of exposure to this noise revealed a similar though more extensive loss.

In an earlier survey made by the Department of Labor in New York State (**48**) 1040 workers in several different noisey industries were tested audiometrically, and the highest incidence of deafness was found to be in those industries with the highest noise-level. In the group of workers exposed to the noise for less than a year it is reported in this study that only 6% appeared to have any hearing loss, while for those exposed to noise for 25 years or more, with no history of a possible causative disease, 26.9% were deaf in some form. It was inferred that these losses for the long tenure group were more than could be accounted for by the normal decrement with age. It was further reported that: "the greatest number of cases of deafening falls in the group between ages 21 and 30 years." Whether this age group tendency would hold true for workers in many other industries is difficult to predict.

Physiology of Deafness. Although extensively studied and much worthwhile information presented on it, the question of the exact organic effects of noise on the hearing mechanism is still not conclusively answered. This is chiefly due to a deficiency in our knowledge of the process of hearing. Good discussions of the hearing mechanism and various aspects of acoustic phenomena may be found in several sources, for example (**8**, **14**, **33**, **43**).

There has been, however, confidence in the scientific foundation of deafness as is illustrated by Goldner's comment (**18**) that: "The etiology of industrial deafness is on a sound pathologic and physiologic basis. The most important findings are degenerative changes in the outer hair cells of the organ of Corti, starting in the basal whorl of the cochlea."

The studies reviewed by Kemp (**24**) on stimulation deafness lead him to comment summarily: "People who work in extremely noisy environ-

ments are often found to be hard of hearing, particularly for high frequencies."

Stevens (44) indicates that the explanation of selective hearing loss, i.e., loss of acuity for specific frequency ranges instead of complete loss, can be made in terms of the construction of the hearing mechanism. He says: "High tones are localized near the basal end of the cochlea, 200 c.p.s. is at the middle and the lower octaves are closely bunched toward the helicotrema."

This arrangement, wherein the high pitches stimulate the basal (outermost) portion and the low pitches stimulate the apical (innermost) portion, makes it logical to conclude that the common and primary occurrence of high tone hearing loss is due to the vulnerability of the high tone receptors.

Auditory Fatigue. Probably every reader of this paper has experienced some degree of hearing loss of a temporary nature. Some decrease in auditory acuity is of such a brief duration that it may be more correctly called auditory fatigue than deafness. Rawdon-Smith (37) and Ewing and Littler (12) studied this fatigue of the hearing mechanism and point out, among other things, that the human threshold of fatigue is definitely lower in terms of intensity than is the threshold of feeling. This is of significance because while an individual does not think that a noise is loud enough to harm him it may unsuspectedly be diminishing his ability to hear. Fleming (13) emphasizes that "prolonged exposure to loud noise may cause permanent deafness . . . while less noise frequently causes temporary loss of hearing." Davis (10) after subjecting 19 men to high intensities of noise resembling airplane noise for several days reported that: "temporary impairment of hearing was regularly produced, but there was no evidence of cumulative injurious effects."

Harmful Noise Levels. Davis (8) says the answer is "yes" to the question, "Will the temporary hearing loss produced day after day and week after week ultimately become permanent?", if the noise is *loud enough* and if a loud exposure is repeated often enough. Davis adds, "We do not know how loud . . . is loud enough" to injure permanently. Hence, it is important to survey noisy indistries and occupations to ascertain the levels which exist, so as to adequately protect the workers against ill effects. There seems to be great variability among individuals in their susceptibility to injury from noise as indicated in some reports (9, 18). However, in spite of this variable resistance it should be possible to grant a good margin of safety so that we can be confident that no workers will be affected adversely.

Various researchers have suggested different levels of noise above which there is danger. Schweisheimer (41) considers that the "hazard

level" falls between 80 and 90 decibels. McCord and Goodell (**29**) have suggested that a level of "80 to 85 decibels will cause some defects of hearing in the high frequency zones after a period of years." McCord and Goodell (**29**), and McCoy (**32**) concur that levels over 100 decibels are a first concern. Davis (**8**) states that "noise of less than 100 decibels may reasonably be considered quite safe except perhaps for a few unusually susceptible individuals." Rosenblith (**38**) admits difficulty in specifying a danger level, but believes "as little as 75 or 85 decibels, if sufficiently prolonged, will suffice to bring about permature aging of the ear." Goldner (**18**) states that "A consensus seems to indicate that the minimum safe level is in the neighborhood of 80 decibels."

In the light of the preceding opinions expressed on noise intensities, based on experience and experimental evidence, it appears from the list of noise levels shown in Table I measured at a distance of three feet from the machines, that operators are subjected to literally deafening intensities.

Sabine and Wilson (**39**) report that: "Noise level measurements were made in 33 separate plants covering a wide diversity of industries and

Table 1

Noise Levels* of Several Machines (From Sabine and Wilson (**39**))

Machine	Decibels**
Punch presses, various types	96–103
Headers	101–105
Drop hammers	99–101
Bumping hammers	100
Hydraulic press	130
Automatic riveters	95–99
Lathes (average)	80
Automatic screw machines	93–100
Airplane propeller grinding	100–105
Cotton spinning	84–87
Looms	94–101
Sewing machines	93–96
Wood planers	98–110
Wood saw	100
Wire rope, stranding machines	100–104
Ball mill	99

* Information is not available on the frequency components of these noise levels.

** Measured at a distance of three feet from the machines. The opinion has been expressed that greatest functional utility of the noise-level measurements would accrue from placing the microphone of the noise-level instrument at the customary position of the ear of the worker engaged in operating the machine. (Dr. M. D. Steer, Voice Science Laboratory, Purdue University.)

machine operations. Of all the readings taken in actual work areas, the highest was 130 db. and the lowest 65 db. In the majority of cases, the observed noise level ranged quite uniformly between approximately 85 and 105 db."

McCoy (32) stresses an important point when he suggests that the opinion of the worker may be unreliable in judging whether a noise is great enough to be harmful, because pain occurs at a higher level than that at which noise is actually harmful to hearing.

From the standpoint of expediency in initiating noise control in industry the advice of McCord and Goodell (29) merits consideration. They advise: "In estimating a hazardous noise level in industry one should, from a practical point of view, use a threshold which will not provide too unwieldy a group requiring preventive treatment so that management will be more likely to take immediate steps."

Compensation for Hearing Loss

Gardner (16) has asked the question in connection with the hearing loss demonstrated in the audiogram of Figure 2: "What is to prevent them [these and similar workers with impaired hearing] from proving their claims in compensation cases?" Bunch (4) reporting on compensation for hearing disability in 1942 stated that:

"Cases of this kind do appear before courts, and compensation boards are making awards for hearing losses. The amount of the award often appears to depend not on the amount of damage to hearing but on the relative technical skills of the representatives of the interested parties. A glance through the decisions from different states shows a lack of uniformity. Only a few states have adopted definite schedules. Insurance companies have worked out no general schedule of awards for acquired hearing defects comparable with that used for acquired visual defects."

That attention is being paid to development of valid and scientific bases for evaluation of hearing loss is illustrated in a comprehensive review by Carter (5) covering eleven methods for determining and recording hearing loss. In 1938 the Consultants on Audiometers and Hearing Aids of the Council on Physical Medicine of the American Medical Association, realizing the lack of uniformity of methods for evaluating the percentage loss of hearing for speech, began formulation of a usable technique. Their work resulted in publication in 1947 of a Tentative Standard Procedure for Evaluating the Percentage Loss of Hearing in Medicolegal Cases (50).

Although this group has done commendable work in formulating this tentative schedule, one might make the criticism that it adjudges only "loss of hearing for speech." Admittedly loss for the hearing of speech

is the important item, but it does seem that often compensation for loss in high and low frequencies should probably be granted if it is construed to be a disability, as it may very well be, e.g., the worker suffering high frequency loss (the most common type) is occasionally endangered and often inconvenienced by not being able to hear the shrill tones of some warning devices.

Dr. W. E. Grove (19), chairman of the sub-committee on noise of the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology, has recently reported initiation of careful, exact, scientific examination of the hearing of employees in noisy industries. This work aims at actual "in plant" study, particularly, in an effort to discover characteristics of those employees whose hearing mechanism may be "noise-susceptible." The work of this group can be expected to throw new light on the noise problem in industry.

Diagnosis of Occupational Deafness. Goldner (18) indicates that the correct diagnosis of occupational deafness is especially important as cases are brought before compensation boards. He finds it worthwhile to describe under the heading of deafness due to noise and explosive sounds, two types of deafness, viz.: (1) *acute* (easily observable and due to explosive noises of extreme intensity) and (2) *chronic* (of most importance to the medical profession, industry and labor . . . "deafness is insidious in onset and the intensity of the noise is below the level of painful stimulation"). Goldner states that the technique for diagnosis of the chronic type is:

". . . based on a history of exposure to noise capable of producing injury to the organs of hearing; a normal ear drum; an elevated threshold for high tones, as manifested on the audiogram and with tuning fork or tests with Galton's whistle; diminished bone conduction, as shown by a positive Rinne and a positive Schwabach test; normal vestibular responses; patent eustachian tubes; differentiation from other lesions capable of producing a similar clinical picture."

Perlman (35) emphasizes the difficulty of determining cause and effect relationship with respect to auditory loss. He gives the following list of the relevant factors influencing the degree of the loss: (1) total time of exposure; (2) length of each exposure; (3) loudness of sound stimulus; (4) age of subject; (5) constitutional factors; (6) character of sound, constant or sharp; (7) use of protective devices; (8) exposure in closed or open spacies; (9) previous aural disease; and (10) frequency of stimulus.

"The problem of determining how much damage of the hearing is due to the accompanying pathologic process and how much is due to industrial noise is a difficult one; each case must be judged individually" (18).

Eliminating or Controlling Noise in Industry

Among the ways of eliminating or at least reducing noise in industry are: acoustical treatment, isolation of the source, reduction of vibration, maintenance and substitute methods, and equipment and plant design.

Lindahl (28) reports that acoustical treatment will yield only 6 to 10 decibel reduction, but he goes on to point out that this amount of change may result in a decrease in loudness, according to the average worker, of anywhere from 30 to 70 per cent which from an attitudinal standpoint, at least, is considerable. A thorough discussion of sound absorption is given by Sabine and Wilson (39). A report of an "in plant" experiment on advantages of acoustical treatment is given by Berrien and Young. (3)

Isolation of noise sources has been the only solution to the noise problem in some plants such as those having engine test stands. Vibration reduction by use of cushioning, rubber and felt mountings for equipment, and even floor suspension has decreased the noise problem in many enterprises. It has been inferred (28) that when the designer tries to reduce vibration to preclude noise he finds very often that he has achieved efficiency.

Quite obvious is the effect of properly maintaining equipment in order to keep its free from rattles, squeaks, etc., which tend to wear both on the human and on the machine. Substitution of quiet operations such as welding for riveting may materially reduce noise levels in those operations where they are feasible.

Forethought given to machine and plant design may solve noise problems before they occur. Johnston (23) suggests that a 5 to 10 degree outward slant of walls deflects sound into sound absorbent materials attached to the ceiling, which should be as low as is practical in order to bring the absorbent material close to the noise source.

In addition to those already mentioned many valuable suggestions on ways to control noise in industry may be found in the published literature, some of which are the following: (1, 7, 13, 22, 28, 30, 39, 47, 49).

In the event of the impossibility of eliminating a noise hazard, as in the case of explosions in some occupations, the use of ear plugs or stoppers is an alternate procedure. McCoy (31) states that: "Workers should be safeguarded against the developing cushion of deafness and urged to wear [ear] protection for health." Other researchers (8, 11, 26, 45) have also recommended various types of ear defenders, from a wad of cotton to the V51-R "Ear Warden."

The "Ear Warden" ear plug was devised in the Psycho-Acoustic Laboratory at Harvard University under the auspices of the National Research Council. It is moulded of soft black neoprene, a synthetic

rubber. It was found to be practical on the basis of ease of insertion, cleanliness, durability, low cost, feasibility of mass production, and comfort to the wearer. Extensive testing demonstrated the efficiency of the plug. (45)

Goldner (18) however, points out a disadvantage of present ear protection when he says: "most workers are reluctant to submit to any effective dampening of normal hearing impulses," because of the obvious interference with detection of warning sounds, either vocal or from machines. He believes that possibly some sort of sound filter can be devised to filter out harmful sound intensities in high or low frequencies and still allow perception of speech.

Other objections (21) to ear plugs are that they cause pressure to build up in the ears and make the ears feel stuffy; they trap moisture in the ear and promote growth of fungi; and further, they may carry infectious material into the ear. The use of external coverings of the ear (ear-caps) has been suggested as a possible solution for exclusion of noise to the ear. They would avoid the difficulties mentioned for the ear-plugs and would be expecially advantageous in that an easy check could be made on whether or not ear protection was actually being used.

In general, if ear protectors of any type are a real safeguard to the worker's welfare it would seem that management's insistence on employees wearing them is as justified as regulations concerning the use of safety eye-wear to prevent damage to the eyes.

Summary

From the standpoint of both management and labor there are many advantages to be gained from control of noise within industry. Complete condemnation of noise in industry may be unwarranted in view of the possible exhilarating influences of some sounds; also, some experimentation (42) suggests that the harmful effect of noise has been overemphasized. However, the greater quantity of the experimental evidence indicates that there are many circumstances wherein noise is deleterious. Especially significant are the deafening effects on the worker in noisy industries. The authors of this article agree with Gruss (20) who concludes, "The great and overwhelming weight of authority is that: (1) hearing is impaired by industrial noise; (2) groups subjected to the loudest noises are most affected. . . ."

The immediate action on the part of the employer who may be confronted by the noise problem would appear to be:

(1) noise measurement, in terms of intensity levels and composition;
(2) institution of feasible noise elimination or reduction measures;
(3) establishment of some form of hearing testing program for workers engaged in noisy occupations, the first step of which would be preemployment audiometric testing of those employees who are to work in "harmful" noise levels.

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Application of Addends to Sales and Clerical Occupational Classification *

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Addends offer a means by which, for a given number of factors and grades within factors, all their possible patterns can be meaningfully coded. Little known, the use of addend coding has been limited mainly to the coding of data to facilitate large-scale statistical research. Yet, as Toops (9, 10) has suggested, addends may have widespread application in biology, sociology, business, and applied psychology.

Following Viteles' (11) original work on the job psychograph, several techniques have been developed which provide for the classification of occupations according to patterns of factors or characteristics and which allow for matching of the individual's combination of characteristics with occupational requirements in the same set of terms.[1] These include the Minnesota Occupational Rating Scales (6), Michelman's (5) method for classifying occupations according to the demands made on the personal characteristics of workers, the Entry Occupational Classification (14) and the Occupational Aptitude Patterns (3) used in conjunction with the new USES General Aptitude Test Battery.

In the study to be presented, an addend classification was developed for 781 sales and clerical occupations to indicate the possibilities of applying addends to occupational classification. This attempt was mainly intended as an experiment in the use of addends and was not necessarily directed towards proving or disproving its value as compared with other existing occupational classification techniques. At present, however, the results obtained have been set up as an experimental counseling aid and distributed to the various vocational and educational counseling agencies at Ohio State University. Evaluation of the addend classification as a new tool for vocational guidance will be forthcoming. The value of

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[1] For further discussion of the implications involved in a truly functional classification of occupations, the reader should refer to Alexander, W. P. Research in guidance: a theroretical basis. *Occupations*, 1934, 12, 75–91.

addend classifications as a personnel technique for business and industry remains to be investigated. At present, one can only speculate as to the potentialities of addend classifications of occupations.

Definitions of some of the most frequently used terms in this report are as follows:

Element. An original job or worker characteristic used by the Occupational Analysis Section of the USES in gathering and processing the information used in this study.

Factor. An element or a group of elements used in construction of the patterns upon which the classification system is based.

Category. The grades which exist within a factor denoting a subdivision or whether or not the factor is required by a given occupation.

Addend. An integer assigned to each category of a factor according to a preconceived numerical system determined by formula.

Addend code. The arithmetical sum of addends which will describe both the factors and the categories of the factors for any given occupation. It is the numerical sum which represents the pattern of requirements of a given occupation.

MET code. The three-character code which describes the machine used, experience required by, and the training necessary to reach maximum production for a given occupation.

Residual code. The code of those factors which appear infrequently. The letters representing the residual factors are included in the total code when the factors are required by a given occupation.

Total code. The combination of addend, MET and residual codes. It will describe seventeen variables and their subdivisions.

For definitions of the various elements see (15), (16) and (17). For definitions of other terms pertinent to addend coding see (10).

The information concerning the 781 sales and clerical occupations (which cover 44 industries) classified in this study came from the extensive research done by the OAS of the USES since 1934 on approximately 9000 occupations. Estimates by job analysts of the worker characteristics required for success were collected, summarized and placed on speed sort cards. Hiring requirements were the minimums given by employers. A card representing each occupation contained all the gathered information on approximately eighty variables.

In terms of the scale of ratings used by the analysts, each characteristic punched on a card indicated that either a very high degree of the characteristic was required in some phase of the job or an above average degree was required, either in numerous tasks of the job or in the major or most skilled task. For the purposes of this present investigation, since "very high" could not be differentiated from "above average," the expedient phrase, "high degree," which would suffice to cover both, was chosen to describe the amount of a given characteristic either required or not required by an occupation. A characteristic was considered to be significantly required to a high degree, or not at all. Since the use of critical scores to dichotomize measured characteristics is a common

practice, the dichotomization used here for estimates should not present too great a semantic problem.

In its present form, the occupational information compiled by the USES lends itself readily to analysis for construction of occupational families. These families may aid the counseling of the unemployed and those interested in changing from one occupation to another. However, they are, as yet, unsuitable for use by vocational interviewers for more generalized problems. It was the intention in this study to develop a method for transforming this information into a system which might make wanted information on occupations ready for practical use in the vocational guidance and employment situations. By coding seven variables with one numerical system and giving information on ten other variables, the classification proposed here may enable the matching of individuals' patterns with occupational patterns to be done quickly, efficiently and easily. A need was recognized for a high degree of flexibility in occupational classifications and allowance for it was incorporated into the addend coding structure. In addition, with the same data used to construct the many Job Family Series, this investigation attempted the development of a method for constructing a "universal" job family as an integral part of the overall addend classification.

The Method

The first operation performed in this present study was to organize into seventeen factors the 81 elements included on the USES speed sort cards. Jaspen (4) through factorial analysis had found several factors which he named strength, intelligence, inspection, physically unpleasant working conditions, mechanical dexterity and mechanical information. It was realized that Jaspen had sampled only skilled, semi-skilled and unskilled industrial occupations and that a factor analysis of sales and clerical occupations might be desirable to insure adaquacy of the factors to be used in classification. However, at the time of this study, such an analysis was not available.[2]

After careful scrutiny of the 781 occupations and following Jaspen's findings when advisable, seven major and ten minor factors were arrived at *a priori*. The seven major factors, the ones deemed most frequent,

[2] Subsequent to this study, Williams (12) completed a factor analysis of the 781 occupations and partly substantiated the major factors selected *a priori*. The factors he found were manual dexterity, intelligence, social intelligence, mental ability, and accuracy. Arithmetic computation fell under the factor of accuracy and mental ability was split into two factors, a higher order intelligence and a mental ability for rote learning. This differentiation was partly taken into account in the addend classification by the educational factor. It also seems to have been profitable to separate arithmetic computation and fine accuracy.

significant and crucial were sex, education, mental ability, manual dexterity, social intelligence, fine accuracy (accuracy in checking, transcribing, typing, filling orders, etc.) and arithmetic computational ability. These were to be the multiple bases for the addend coding structure. As will be seen later, provision was also made for the ten other factors which for one reason or another were not included in the addend part of the total code.

It was apparent that finding the proper occupation or occupations for an individual (i.e., matching the individual and the occupation) would first involve finding the occupation with the highest possible pattern of requirements or factors which the individual both could and would fulfill. To give the classification greater value through greater flexibility, it would be necessary to be able also to arrive at occupations other than those with the pattern of the maximum requirements which the individual could and would fulfill.

To classify occupations according to their patterns of requirements and to accomplish the previously mentioned objectives, addends were used to develop the major part of the classification coding system presented in this study. Toops (**9**), in 1935, described a method which he stated "would be a practical means of coding human test profiles, and would enable all scientific classification systems to become more generally useful." This, the addend technique, was a means of numerically coding all possible profiles that might exist in n traits, either qualitative or quantitative. All the permutations of profiles possible among n traits, taking the traits n at a time, could be meaningfully coded.

Statistical control was acquired by the development of a formula applicable to addends where the number of categories per trait was a constant. The formula Toops (**9**, p. 2181) presented was:

$$A = n(N + 1)^{m-1},$$

where A = addend appropriate to a given category of a trait in question.
N = number of categories per trait (a constant).
n = position of the category compared with others for the same trait.
m = the number of the trait.

Since the information used in this present study of occupations would not permit a constant number of categories, a more generalized formula which would yield addends when the number of categories varied, was necessary. During the course of this investigation such a generalized formula was found which would apply to all coding situations. It is as follows:

$$A = (n-1)\left[N_{(m-1)}N_{(m-2)} \cdots N_1 + \frac{1}{m^{\infty}}\right],$$

where A = addend appropriate to a given category of a factor in question.
N = number of categories for a given factor (variable).
n = position of the category compared with others for the same factor.
m = the number of the factor.

When considering the first factor, or when $m = 1$, then $\frac{1}{m^\infty} = 1$; when considering the rest of the factors, or when m is greater than 1, then, $\frac{1}{m^\infty} = 0$, and drops out of the equation. The term $N_{(m-1)}N_{(m-2)} \cdots N_1$ begins with the number of categories in the factor preceding the one under consideration, and is the product of the number of categories in each of the preceding factors. As there is no factor, hence no categories preceding factor No. 1, when finding the addends for factor No. 1, the term is equal to 0.

Sex, which had three categories, male required, either sex required and female required was chosen as factor No. 1. Substituting in the generalized formula, the addends appropriate to the three categories were 0, 1 and 2 respectively. Sex was placed as the first factor of the classification in order to introduce a high degree of flexibility. If no suitable occupation were available for a male with any given pattern, addition of 1 to his addend code would yield all the occupations with job patterns the same as his except that either sex could qualify for the occupation. Similarly, subtracting 1 from any female's code would do likewise.

Table 1 presents the addends appropriate to each of the categories of each of the factors of the addend system used to classify the 781 sales and clerical occupations.

If one or more elements were required to a high degree by an occupation, then the factor under which the element was grouped was considered as required to a high degree by the occupation in question. Coding of occupations required simple addition of the correct addend for each factor but only one addend for each factor could be added. The decoding of an addend code, whenever necessary, is a process of simple subtraction. The method is to subtract successively, the largest addends of the system, which are still contained in the successive remainders of the addend code. The addends subtracted identify the original categories of the factors which are required by the occupation so addend coded.

The total number of addend codes possible was 384, running from 0 through 383.

An example of an addend code is 66, which indicates that the occupation with such a code number requires a male (addend 0), high school

Table 1

The Addend System for Clerical and Sales Occupations

		Position of the Categories and Their Addends								
	n =	1		2		3		4		
m	Job Factor	A		A		A		A		N
1.	Sex	0	Male	1	Either	2	Female			3
2.	Education	0	Less than grammar	3	(8th–12th)	6	(12–16th)	9	(16th)	4
3.	Mental Ability	0	Not required	12	Required					2
4.	Manual Dexterity	0	Not required	24	Required					2
5.	Social Intelligence	0	Not required	48	Required					2
6.	Fine Accuracy	0	Not required	96	Required					2
7.	Arithmetic Computation	0	Not required	192	Required					2

graduate (addend 6), with a high degree of mental ability (addend 12), and a high degree of social intelligence (addend 48).

The MET code which follows after the addend code was in the typical symbol form. The first letter of the MET code represented the type of machine or machines fed, tended or operated by the occupation so coded. Usually, the letter code used was the initial of the machine's name. Thus A is the code for adding machine, T for typewriter and N indicates that no machine is used.

The next symbol of the MET code, a digit, indicated the type of experience required by the occupation so coded. None, same, similar or other experience or some combination of the latter three were coded by the use of one of nine digits.

The last symbol, a digit, indicated the amount of training in terms of time required by the occupation so coded to reach maximum production. This varied from less than a day's training to more than six month's training and was represented by 0, 2, 4, 6, and 8.

An example of the MET code is A28 which indicates that an adding machine is operated, similar previous experience is required and more than six months' training is needed to reach maximum production in the occupation so coded.

Why were not the machines, experience and training factors included in the addend code instead of being set up as a separate part of the total code? The main reason is that none of these three factors could fit into a counselee-occupation matching procedure. It should be obvious that

experience could not be considered without particular reference to a given occupation. Thus, the occupation must be established by the addend code before experience can be discussed by the counselor with the counselee. Similarly, "training required" could in no way be discussed with the counselee until the occupation was found with the training requirements to be considered. Then, the question would be whether the counselee was willing to undergo the training required.

The residual code represented those factors which occurred infrequently enough to be coded in straight symbol fashion. If the residual factor was required to a high degree by a given occupation, a letter representing that factor was included in the occupation's total code. Otherwise, the letter did not appear. There were seven residual factors with code letters as follows: C = Concentrate Amid Distractions, K = Special Knowledge Required, P = Perceptual or Estimating Ability, R = Repetitive Job, S = Strength Required, U = Unpleasant or Hazardous Conditions, X = Seasonal Job.

An example of a total code, with its addend, MET and residual components is 66-A28-CP. From this code, the reader can now describe which of seventeen factors and their various subdivisions are required by an occupation with such a code number.

Results

The 781 clerical and sales occupations were coded according to their requirements as explained in the previous sections and listed according to the numerical order of their respective codes. Because of space limitations, only a sample of the list can be presented in this report. For the complete list refer to Bass (1).

Included with the list of coded occupations are examples of work performed by arbitrarily grouped families of occupations. Each group of 12 addends beginning with 0 are a family of occupations which vary only in sex and educational requirements. The work performed is arbitrarily defined as all the action verbs present in more than 10% of the occuaptions of a given family. For example, the 12 addend codes from 0 through 11 are codes of occupations which only have sex and educational requirements. The work done by this family of occupations according to the action verbs found in more than 10% of the occupations of the family includes checking, filing, sorting and typing.

Much interesting occupational information was observed by inspection of the addend coded lists. The generalizations which follow were set down as inferences arrived at through observation and inspection and should be verified by statistical treatment. For the purpose of economy,

Table 2

Sample of the List of Addend Coded Occupations*

Total Code	DOT Code	Occupational Title and Industry
0-N00	1-23.14	Messenger (clerical)
15-N04-R	1-18.66	Checker (iron and steel)
31-T00-R	1-37.34	Clerk, typist (insurance)
48-N02	1-23.14	Delivery boy (garment)
66-N32	1-55.10	Soliciter (business services)
100-N04-X	1-17.01	File clerk (clerical)
114-N00-K	1-38.01	Stock clerk, aircraft shop (air transportation)
126-T22-R	1-37.34	Securities index clerk (banking)
140-T02	1-37.12	Stenographer (clerical)
220-A06-R	1-05.01	Sales tax clerk (clerical)
261-N40	1-65.04	Municipal bond buyer (financial)
305-N06-KP	1-18.66	Production weigher (textile)
328-N02	1-26.03	Timekeeper (clerical)
352-N76-R	1-03.02	Receive clerk (financial)
381-A06-KP	1-48.24	Field contact man (dairy products)

* Copy of the addend list of occupations with directions for its use can be obtained from the author, c/o Occupational Opportunities Service, Ohio State University.

whenever a factor is mentioned in the following discussion, a high degree of the factor will be implied but not repeatedly stated as such.

Some of the conclusions drawn are as follows:

1. Most of the occupations with no requirements other than sex or education, are straight repetitive occupations which involve little responsibility and few decisions. Only as education requirements increase is much training or experience necessary. Many occupations in this family are entry occupations.

2. Social intelligence is the major dichotomizing factor between sales and clerical occupations. While clerical occupations may or may not require social intelligence, most sales occupations do require a high degree of this factor.

3. Certain industries tend to dominate certain families of occupations, i.e., occupations with a specific pattern of requirements are peculiar to one or two industries.

4. Those occupations which require only a high degree of social intelligence (with varying sex and educational requirements) are, for the most part, entry occupations and the relatively unskilled "meet the public" occupations. When mental ability requirements are combined with social intelligence requirements, higher skilled "meet the public" occupations arise and supervisory work enters the family.

5. Quite often, a group of occupations with the same DOT classification numbers showed the same addend codes. One may infer that some relation exists between occupational requirements upon which the addend system is based and work done and industry upon which the DOT is primarily based. For many examples of the relationships that appear to exist between occupational requirements and work done, see Bass (1).

The 781 occupations were described by 188 patterns, i.e., 188 out of a possible 384 addend codes were used to represent the 781 occupations. Seldom did one addend code represent more than fifteen occupations.

Three reasons can be advanced for failure to use all possible 384 addend codes. The fixed structure of the addend system left 25 per cent of the addend codes open to college graduates, whereas only 2 per cent of the occupations required college graduates. Two-thirds of the addend codes were available for occupations which required females or had no sex requirement, whereas only 41 per cent of the occupations were in these two categories. Lastly, as Williams (12) found, there was a correlation between fine accuracy and arithmetic computation so that many of the addend codes available for occupations with only the latter factor were left unused.

Applications of Addend Classified Occupations

Directions for using the addend coded list of occupations have been set up. Following these directions, the interviewer fills out a simple schedule to obtain the interviewee's basic addend code. The interviewer does this by placing on the schedule those addends appropriate to the estimated and tested abilities and interests of the interviewee. The interviewer, then, finds the sum of the addends on the schedule, consults the addend coded list and discusses with the interviewee those occupations which have addend codes which match the interviewee's basic addend code. If such occupations do not exist, or for some reason are unsatisfactory, then the interviewer returns to the schedule and obtains as many secondary addend codes as are necessary to find satisfactory occupations. As has been pointed out earlier, the addend system has been devised so that by simple addition or substraction of known quantities (given in the directions), many secondary addend codes can be assigned to the interviewee which are consistent with his abilities and interests. Sex and educational requirements can be manipulated and other requirements can be eliminated as desired. The schedule has been arranged to allow the interviewer to perform these operations while in the process of filling out the schedule.

Another interesting and important feature is inherent in the addend classification. Occupational families based on a single factor or requirement, or any designated combination of factors can be easily determined after the occupations have been addend coded. Construction of families can be done almost as if the list of addend coded occupations remained as a pack of speed sort cards, with the same factors present or absent. Now, however, instead of sorting with a needle, one sorts by mathematical means.

Listed below are two of the twelve arithmetic expressions or formulae for selecting all occupations with a given requirement.

1. To select all occupations which require a high degree of fine accuracy (addend 96), select all occupations whose addend codes are between 96 and 191 and between 288 and 383 inclusive. If F represents the addend for fine accuracy, then the algebraic expression for obtaining a family of occupations which require fine accuracy becomes $F, F + 1 \cdots 2F - 1, 3F, 3F + 1 \cdots 4F - 1$.

2. To sort out all male occupations, select all occupations whose addend codes are multiples of 3; namely 0, 3, 6, 9, $\cdots$ 381. The arithmetic expression becomes $0 \times 3, 1 \times 3, 2 \times 3, 3 \times 3 \cdots 127 \times 3$.

Any combination of factors to form a family based on a designated pattern of requirements is possible. For example, to select all occupations for males which require a high degree of fine accuracy, one selects addend codes which can both satisfy the expression for fine accuracy as well as the expression for the male requirement. Thus, one would choose all occupations whose addend codes were multiples of 3 and were included between 96 and 191 and between 288 and 383. Neither addend code 3 nor addend code 97 satisfy both expressions, whereas 99 does and is one of the codes selected.

In summary, the list of addend coded occupations can be used as a "universal" occupational family by the simple expedient of constructing an alphabetical or DOT cross-reference index. If an interviewee has had successful experience in a given occupation, the interviewer can obtain the addend code of that occupation from a furnished cross-reference index, and then refer to the occupations listed according to their addend codes. He could find other occupations with the same or similar addend codes which represented occupations into which the interviewee might profitably transfer.

It would seem that the addend classification of occupations in large plants and industries might faciliate the efficiency of transfer and promotion as well as aid in selection procedures. Add in the possibility of its use in coding the results of job evaluations, and the values of an addend

classification applied in an industrial organizational structure would appear to be manifold.

By knowing an occupation or job's addend code number, a personnel workers, acquainted with the addend system used in his plant, would be able to describe immediately the pattern of factors which were required by that job or occupations. He would be able to do this without any need to refer to his office files. In conference, he might have a better command of the total occupational structure of the plant, for the addend system would provide a good frame of reference for him. During conversations with workers while outside his office, the personnel worker might be better equipped to discuss the requirements of the workers' jobs.

Likewise, if desired, the worker on his job would know where he stood in relation to other workers on other jobs. He could have some understanding of his transfer and promotion possibilities. If job evaluation results were addend coded, the worker might be able to understand why and how his job was evaluated in relation to others.

Discussion

Shartle (7) suggested that the individual counseling agency take available source material on occupations and punch the items on small-size speed sort cards and supplement them with notations on information gathered from local establishments.

> In counseling, the cards can be quickly sorted as questions arise. Suppose, for example, that a counselee is a high school graduate, he likes working with machines, and he apparently has good dexterity. It is possible to reveal immediately a family of occupations which possess these characteristics. . . .
>
> The same type of fiexible arrangement can be provided for jobs within a plant. The items can be taken from job descriptions and may include additional information such as department numbers, suitability for women and wage rates . . . (7, p. 184)

The techniques described in this present study accomplish the same purposes. Instead of having a collection of occupations on punched cards, the occupations are now coded and presented in tabular fashion. However, because of the peculiar qualities of the code, the information remains just as available as if still on punched cards. Instead of sorting with a needle, sorting can be done by simple arithmetic. But appreciate the difference between having to mass duplicate one thousand cards and printing one list of a thousand codes and occupations. A thousand cards will be approximately a foot in thickness; a list of a thousand occupations takes no more than twenty typewritten pages.

Many alternative approaches to applying addends to occupational classifications are possible. One could assign factors to occupations on on the basis of test results or expert ratings; one could use fields of work as the basic units to be coded; one could substitute crucial and significant

elements for factors; and one could use factors obtained originally by job analysis.

Limitations

Along with the advantages of addend coding, there are several difficulties inherent either in addends themselves or in all approaches to systematizing psychological patterns. Some of these limitations are as follows:

1. Since addend coding involves a geometric progression, there is a limit to the number of classification factors which can be coded before the addend system becomes cumbersome and the ensuing arithmetic computations become complicated and laborious.
2. Although only simple addition is involved, in the everyday counseling situation, errors in computation may occur. This tendency may be mitigated after the user becomes thoroughly familiarized with the addend structure he is using, after a few days of practice.
3. "One and one seldom make two," when psychological entities are involved. In the development of addend systems, as well as of any methods of grouping, quantifying, classifying and typing of traits, one must be aware that any psychological pattern is not merely the sum of its parts.
4. As with other counseling aids, the tendency may increase to rely too heavily on the addend list for occupational advice as if it were an oracle rather than merely a list of suggestions and possibilities. No matter how accurate the data, no matter how perfect the system, such a mechanistic type of guidance cannot be justified. Instead this system should be used only as another tool useful in the dynamics of the interview, in which the interviewee gains insight into his occupational abilities, interests and opportunities and attempts to resolve them accordingly.
5. Changing occupational information will not only mean eliminating certain occupations and adding newly created ones, but it will also necessitate reclassification of existing occupations. For instance, during periods of labor scarcity, educational requirements will tend to be relaxed. As the economic scene changes to one of labor surplus, educational requirements may be greatly increased.

Summary

1. Information compiled by the USES, now present only on speed sort cards, accessible to very few counselors and unwieldy in the counseling situation, may be converted into easily printed and easily distributed lists which will make this information readily available in usable form to all counseling and employment centers.

2. Seven variables have been coded by one numerical system. Instead of each factor needing a symbol of its own, the factors can all be coded into one *meaningful* group of one to three digits.

3. Occupational data, when classified and coded into an addend system, become a "universal" occupational family. Such a "universal" family does not have to be based on one factor, one fixed combination of factors or one occupation. Literally, hundreds of occupational families exist within an addend coded list of occupations.

4. With proper use and caution, this type of classification presents a wealth of occupational information for efficient and speedy appraisal in the vocational counseling and placement situations.

5. Addend classifications, when applied to industrial situations, may facilitate flexibility of organization in that it may make more efficient the hiring, transferring and promoting of employees.

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Effects of High Altitude on Speech Intelligibility *

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Smith and Seitz (6) and Smith (7) discussed in recent articles the deleterious effects of anoxia on the intelligibility of speech presented over an interphone. They produced anoxia by reducing in a chamber the content of oxygen to correspond to the oxygen content found at altitudes ranging up to 20,100 feet. They deduced from their findings that during flight at altitudes above 13,600 feet oxygen equipment should be used in order to keep interphone communication as effective as it is at sea level.

Anoxia with subsequent "wandering of attention" on the part of the subjects is, however, only one of the ways in which increased altitude can lessen the intelligibility of interphone communication; in addition, the reduction of pressure at increased altitude can lower speech intelligibility over an interphone by affecting adversely the operation of the voice, the microphone and the earphones. Indeed, with the effort exerted by the talker kept constant it is found (5) that at 20,000 feet the speech signal reaching the listerner over his earphones is ¼ the pressure the signal would be at sea level, and at 40,000 feet it is reduced in intensity to about 1/16 its sea level pressure, because of decreased sensitivity of microphone and earphones and loss in speech intensity. These losses are severe enough to depress speech communication and are, of course, independent of wheather or not oxygen equipment to prevent anoxia is used.

Since Smith and Seitz simulated what they called "high altitude" merely by a reduction in the oxygen content in a chamber, their findings do not reflect the true course of speech communication efficiency as a function of altitude.

The present study was addressed to the problem of the effects of true altitude from 5000 to 35,000 feet above sea level on speech intelligibility. Tests were conducted over a standard U. S. Army Aircraft interphone during flight in B-17F bombers. Anoxia was prevented in the present work by the use of oxygen equipment.

* The data in this paper are taken from a joint Aircraft Radio Laboratory—Office of Scientific Research and Development report (2) issued during the war. The research was completed at Eglin Field, Florida, in the summer of 1944 under Contract OEMsr-658 between the Office of Scientific Research and Development and Psycho-Acoustic Laboratory, Harvard University.

Since Smith and Seitz evaluated only the effects of anoxia, their work and the present study can be considered as complementary for the purpose of estimating the possible effects of flight at high latitude (up to 20,100 feet) without oxygen equipment upon speech intelligibility.

Test Procedures

The principal method used in quantifying the effectiveness of interphone communication was the word articulation test. This method provides a measure of intelligibility, per cent word articulation, based on the percentage of discrete words heard correctly over a particular circuit under given conditions. In a typical articulation test, a talker reads a list of monosyllabic words over an interphone to a group of listeners. He places each test word in a carrier sentence, as "You will write——." The listeners record the words as they hear them, and the percentage of the words recorded correctly by the group of listeners constitutes the articulation score. For a complete account of speech articulation testing methods developed at the Psycho-Acoustic Laboratory during the war the reader is referred to an article by Egan (1).

Personnel. In many respects the articulation testing crew was a very heterogeneous group, and, by the same token, representative of airplane crews in general. The crew members were Army Air Forces personnel, average or above in intelligence, and qualified for high-altitude flying. The men were trained daily for several weeks in the ground laboratory. During the training, they served both as speakers and as listeners and used all of the standard types of interphone equipment. Thus they became familiar with one another's peculiarities of speech, and they learned to pronounce and to spell the words and to use the interphone equipment.

Following the training, the men were fitted with oxygen masks and were given experience with oxygen equipment in an altitude chamber.

Speech Material and Delivery. The words used in the articulation tests were arranged in lists of 50, drawn from a total vocabulary of 1200 monosyllabic words in such a way that the individual lists had the same proportionate phonetic composition as everyday speech and were, as determined by actual test, essentially equivalent in difficulty. The order of words in each of the 24 master lists was rearranged 20 times to provide 480 test lists. Scores obtained with one test list can be compared directly with scores obtained with any other.

The instruction to each of the speakers before each flight was simply that he should make himself as intelligible as possible while reading tests. The sound of his own speech in his earphones was his only clue as to how intelligibly he was speaking and as to what signal strength he was producing. Thus, an effort was made to have each speaker use the inter-

phone just as he would on a bombing mission. The talkers paced themselves at a rate which allowed the listeners to record the words easily; on the average, the interval between test words was approximately three seconds.

Flight Plan. B-17F (Flying Fortress) bombers were used for all the flight experiments.

On each flight, the articulation crew consisted of seven or eight men, depending upon the number of oxygen stations available in a particular B-17F. Two experimenters accompanied the crew on each flight, one supervising the tests from the radio compartment, the other keeping records and making physical measurements in either the bombardier's or the tail gunner's compartment. The men in the waist, tail, and the ball turret had electrically heated flying suits, while the remainder wore fleece-lined clothing.

Unless the flights were interrupted by engine trouble, fuel shortage, oxygen leaks, or the bends, it was possible to follow, approximately, a flight plan which involved:

Take off and ascent to 5,000 feet	
Level flight at 5,000 feet	1 hour
Ascent from 5,000 to 35,000 feet	1 hour
Level flight at 35,000 feet	1 hour
Descent from 35,000 feet to sea level	1 hour

Inasmuch as 35,000[1] feet was near the ceiling of the planes in which the tests were conducted, it was necessary on some of the flights to conduct the high-altitude tests at 33,000 feet, whereas on others it was possible to go as high as 37,000 feet and to remain at high altitude for as long as 1 hour and 35 minutes.

Interphone Equipment. In order to determine the functional relation between altitude and intelligibility, articulation tests were conducted during ascent and descent, using a system consisting of the following standard Army Air Force components: (1) AAF oxygen mask (A-14); (2) Air-activated carbon microphone (ANB-M-Cl); (3) Fixed-gain amplifier (BC-347-C); (4) Magnetic earphones (ANB-H-1); and (5) Helmet (AN-H-14) with noise excluding earphone sockets (AN-48440-1).

Results and Discussion

The ascents and descents of 13 high-altitude flights were devoted to the determination of the relation between intelligibility and altitude (2). On each flight, from two to four members of the testing crew took turns

[1] The altitudes mentioned in this report are "pressure" altitudes. At the temperatures encountered during the high-altitude tests, a pressure altitude of 33,000 feet corresponds to a "tape-line" altitude of 35,000 feet.

serving as talkers, reading the test lists to the other members who served as listeners. Individual curves were plotted for each talker, one for ascent and one for descent. From the individual curves, articulation scores for altitudes between 5000 and 35,000 feet were obtained by interpolation at 5000-foot intervals. Summary curves, shown in Figure 1, were then based on the interpolated values. The curves show that intelligibility falls off gradually up to approximately 25,000 feet, then declines more rapidly.

It is of interest to note, in Figure 1, that the articulation scores obtained during descent were higher, on the average, than those obtained at

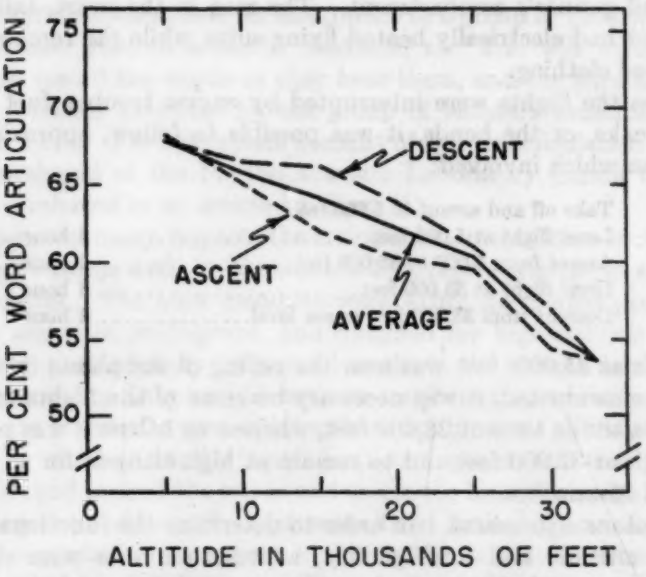

FIG. 1. Intelligibility of speech as a function of altitude.

The dashed curves, based on 29 pairs of individual functions for 12 talkers, show the percentages of the test words understood correctly at various altitudes during ascent and descent. The solid line represents the overall average.

the same altitudes during ascent. This "hysteresis" effect may be explained at least in part as follows:

(a) The members of the test crew appeared to get a "lift" from the completion of the high-altitude tests. It was good to be alive and on the way down. The slightly improved performance during descent may therefore have been the result of increased motivation.

(b) The noise level in the plane was somewhat higher during ascent than during descent; more power was required for climbing than for descending.

The fact that the scores obtained during the last half of the testing schedule were no lower for comparable altitudes than those obtained during ascent indicates that the decrement in intelligibility scores as a function of altitude cannot be attributed to fatigue, or boredom.

It has been amply demonstrated (1) that the measurement of changes due to variations of stress upon the communication system in speech intelligibility is dependent to a large degree on the following factors:

(1) The type of speech material used in the tests. Sentence intelligibility, for example, is less susceptible to deterioration than word intelligibility.

(2) The interphone system employed. The better the system the higher will be the speech intelligibility scores and the greater must be the stress before they are adversely affected.

The measured changes in intelligibility probably would have been different, therefore, had a different type of test material or a different type of interphone been employed. The discrete monosyllabic word articulation test was chosen for this study because: (a) it is a more severe and hence a more sensitive test of communication under conditions of stress, and (b) military communication under battle conditions often

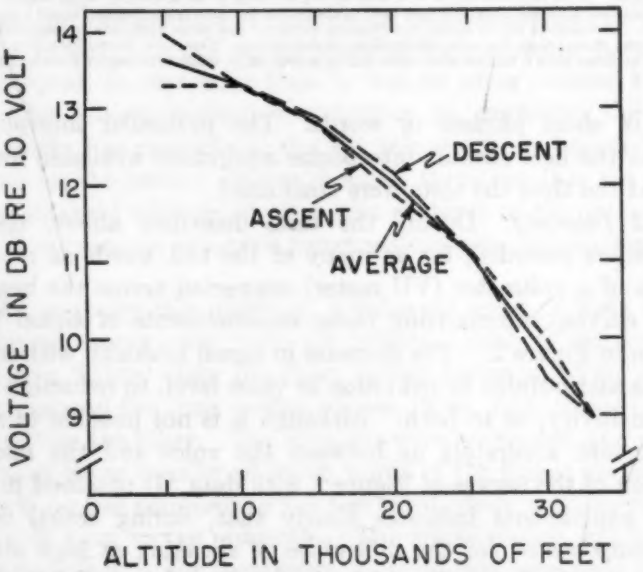

FIG. 2. Signal intensity as a function of altitude.

The curves show that, in the articulation tests conducted during ascent and descent, the intensity of the speech signal followed a course roughly parallel to that of the articulation scores (cf. Figure 1). The measurements of signal intensity were made with a voltmeter (VU meter) connected across the headsets. Thus they reflect the drop in voice level with increasing altitude and, in addition, the change in the sensitivity of the microphone.

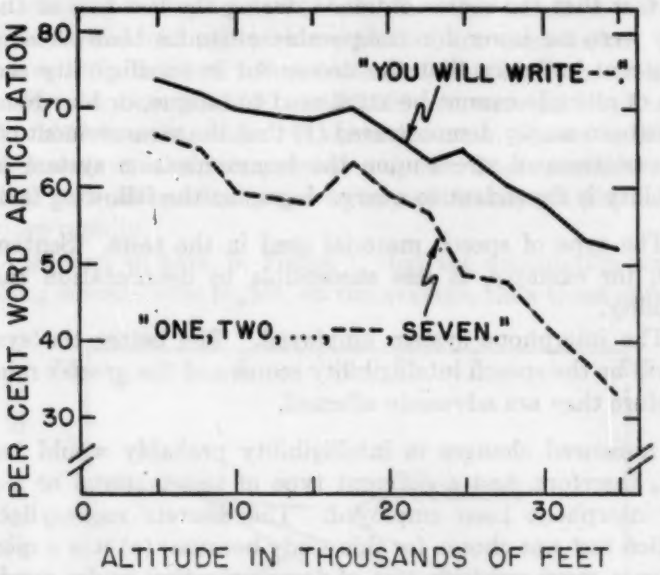

FIG. 3. Effect of substituting a more difficult carrier phase for "You will write ——."

The solid curve shows the relation between intelligibility and altitude as determined with the standard carrier sentence. (This function starts at a slightly higher level of intelligibility than that shown in Figure 1, probably because different speakers were used in obtaining the data presented in Figure 1 and those shown in Figure 3.) The dashed curve shows the relation between the same variables as determined under the same conditions, except that the more demanding carrier phrase, "One, two, three, four, five, ——, seven," was used. For these tests 6 talkers read tests during ascent only, using alternately the standard and longer carrier phrase.

consists of short phrases or words. The particular interphone used represents the best aircraft interphone equipment available for military aircraft at the time the tests were conducted.

Signal Intensity. During the tests described above, one of the experimenters recorded, for as many of the test words as possible, the deflection of a voltmeter (VU meter) connected across the headset line. Average curves, summarizing these measurements of signal intensity, are shown in Figure 2. The decrease in signal intensity with increase in altitude is attributable to reduction in voice level, to reduction in microphone sensitivity, or to both. Although it is not possible to apportion the decrement accurately as between the voice and the microphone, comparison of the curves of Figure 2 with data (5) obtained in altitude-chamber experiments indicates clearly that, during actual flight, the talkers compensated for the difficulties of speaking at high altitude by increasing vocal effort. The altitude-chamber data indicate that, with constant effort, the drop in voice level between 5000 and 33,000 feet is 7 or 8 decibels, whereas the decrement shown in Figure 3 is only a little over 4 decibels. Thus the decrement due to the voice (and microphone)

in actual flight is considerably less than the decrement due to the voice alone with constant effort.

There is a parallel between the functions relating intelligibility to altitude (Figure 1) and the functions relating signal intensity to altitude (Figure 2). This parallel would suggest that the difficulty in communication at high altitudes results at least in part from the weakness of the speech signal delivered to the listeners' earphones. Actually, since the earphones themselves decrease in sensitivity with increasing altitude (a drop of around 10 decibels at 35,000 feet), the decline in signal intensity at the listeners' ears is more marked than the curves of Figure 2 suggest.

In order to determine how much increasing the signal intensity would improve high-altitude communication, further experiments were conducted with a variable-gain interphone amplifier (3, 4). In these tests, the gain (and consequently the intensity of the signal at the listeners' ears) was varied systematically. The optimal gain for high-altitude proved to be approximately 12 decibels greater than that required at 5000 feet.

The decrease in signal intensity is, of course, not the only factor contributing to the reduction of intelligibility at high altitude. Other factors, such as alteration of the frequency characteristics of the interphone components at high altitudes, may have further detrimental effects upon the intelligibility of interphone communication.

Sentence Length. It was noted that, at high altitude, it was more difficult to speak in sentences than it was to utter isolated words or phrases. The talkers resisted instructions to enunciate the carrier, "You will write," as carefully as the key test words, and tended to save their breath for the latter. It was thought, therefore, that the articulation scores obtained with the short carrier sentence might not reflect the difficulty of carrying on extended conversations over interphones at high altitudes.

In order to study this question, a balanced series of tests was conducted, during ascent only, with six talkers. Each of the six talkers served on two flights, using the short carrier sentence, "You will write ——," on one and the long carrier phrase, "One, two, three, four, five, ——, seven," on the other. The speakers were instructed, and reminded frequently, to stress equally all seven words of the longer phrase, giving no more and no less emphasis to the test word which was inserted in the place of "six" than to the numerals. The whole phrase was to be said with a single breath. For these tests, 21-word lists were used instead of the 50-word lists described above.

The summary curves, shown in Figure 3, indicate that intelligibility was consistently lower with the long carrier than it was with the short

one. More important, the scores obtained with "One, two, three, four, five, ——, seven," declined more rapidly with increasing altitude than did those obtained with "You will write ——." The decrement between 5000 feet and 35,000 feet was 21 articulation points with the short carrier, 33 articulation points with the long carrier.

It was thought that an explanation for the disproportionate difficulty of speaking in longer sentences would be found in the measurements of speech intensity which were made during the tests, that speech intensity would decline more rapidly as a function of altitude with the long carrier than with the short one. The measurements indicated (Figure 4),

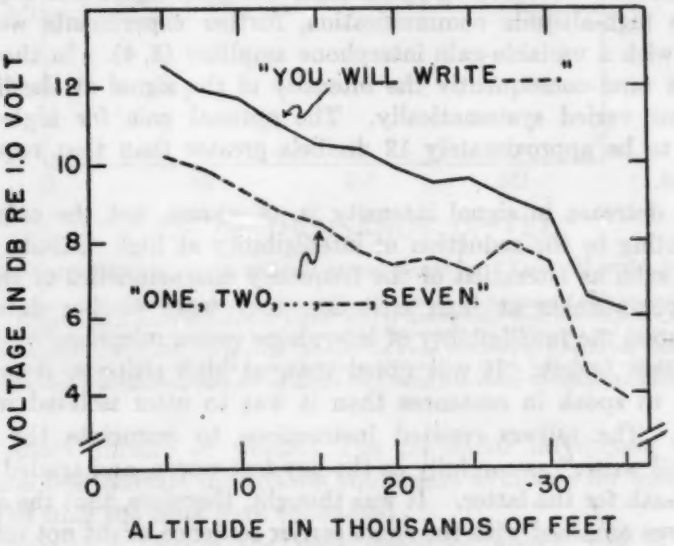

FIG. 4. Signal intensity with standard and long carrier phrase.

Showing the relation between altitude and average speech levels derived from monitoring records of articulation tests read with carrier sentence, "You will write ——," and with carrier phrase, "One, two, three, four, five, ——, seven," during ascent to 35,000 feet in B-17F bomber. The measurements of signal intensity were made with a voltmeter (VU meter) connected across the headsets. Each curve based on the average of six functions made by six speakers.

however, that the key word in "One, two, three, four, five, ——, seven" was on the average, at 35,000 feet as well as at 5000 feet, about 2 decibels weaker than the key word in "You will write ——." It appears, therefore, that speech intensity did not decline any more rapidly with the long carrier than with the short, but that, in endeavoring to maintain adequate intensity level with the long carrier, the talkers relaxed in their efforts to enunciate clearly.

Summary and Conclusion

Intelligibility of discrete words over a standard aircraft interphone is shown to decrease during flight from about 65% words correctly heard at

5000 feet to near 40% (Figure 1) at 35,000 feet. This deterioration in speech intelligibility is attributable to a depression in the operating efficiency of the voice, the microphone and the earphones as the result of the reduced pressures encountered at high altitude. Anoxia did not play a role since oxygen equipment insured an adequate supply of oxygen to the subjects at all altitudes.

The facts show that if speech intelligibility is to be kept at sea level or low altitude efficiency, which is under some circumstances none too high to begin with, adequate compensation in terms of additional interphone amplifier gains must be provided at high altitudes.

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* The reports preceded by number and asterisk are based on findings of the joint Psycho-Ascoustic Laboratory, Harvard University, and Aircraft Radio Laboratory, Wright Field, high altitude project at Eglin Field, Florida.

The Interpretation of Interest Profiles

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Every counselor in a Veterans Administration Guidance Center is faced, from time to time, in the routine performance of his duties, with the need to review an advisement which had been completed at an earlier date and perhaps in a distant city, which for one reason or another had proved unsatisfactory with the passage of time. At such times, one studies the earlier record to see what might be learnt from it for one's own future work. The decision to write this article came out of the writer's conviction that in a number of such cases there seemed to have been a too complete reliance on the high points of the interest profile. For example, in a recent case, a veteran who had abandoned the course of professional training that had been selected in the original advisement, came to ask confirmation for another, which would be academically less demanding. The new objective was still unsuitable. Both were related to the high points of the interest profile, which, as is often the case, is better remembered by the client than any other tests. This veteran had really excellent mechanical aptitude, but a low average score in mechanical interest. For this reason, mechanical objectives had not been seriously considered. The first two sessions were taken up largely with discussion of reasons why the veteran was so desirous of studying for a professional objective. In the third, he announced with enthusiasm that he had found a really excellent training opportunity, for a mechanical trade. In what follows, we shall try to show why, in many such cases, the lower score for mechanical or commercial interest should not be regarded as a serious deterrent to success, and to offer data which will assist in the more useful interpretation of interest profiles.

We shall try to show that the customary almost exclusive concern with the high points of the profile fails to take account of certain necessary implications which arise from the fact that the different occupational fields represented by the separate scales of an interest inventory offer employment to widely different numbers of workers. Every counselor knows that other facts in the record, such as aptitude scores, may influence the weight to be given to interest scores. It is our intention to show that, *other things being equal*, an average score on one interest scale may represent a more positive indication for entry into the corresponding

field than a score that is considerably and quite reliably above average in another field.

The Kuder Preference Record has been found to be the most commonly used of all tests in guidance centers (1). Its manual (4) states: "Look over the profile to see which scores are above the 75th percentile. . . . If there are no scores above the 75th percentile, scores above the 65th percentile should be inspected." A footnote adds: ". . . There is probably little to be gained by attempting to set up separate cutting points for each scale, and there is much to be lost in convenience of interpretation. . . . Scores well above the 75th percentile can be regarded with greater confidence. Those somewhat below it may deserve some consideration but must be regarded as less likely to be an expression of a true interest in the field."

In these recommendations, there is an implicit assumption that equal rankings on the different scales represent equal intensities of interest. It is implied that a score at the 65th percentile on one scale represents less interest in that field than a score at the 85th percentile on another scale. This is not necessarily true, although it might hold for a given interest inventory. It is obvious that a low rank in one field may represent greater interest than a higher rank in another, less popular field.

Suppose, for example, that our interest inventory included a scale for Parenthood. The high-school girl whose score is at the 25th percentile for Parenthood may have a rather intense interest in the prospect of marriage, children, and home management, and the probability is high that she will in time become a mother. Unless we are ready to recommend wholesale revision of our social institutions, we should have to set our cutting point on this scale below the 25th percentile. This would be very obvious, if we dealt with an interest scale for Parenthood, and discussed its implications with our clients. The principle is the same for other fields, for which we do measure interest, and which we do discuss with out clients.

Not 25 per cent of employed urban men, but approximately 40 per cent, are engaged in occupations of a mechanical nature. It is, therefore, a statistical absurdity to expect that all the men who enter the mechanical field shall have mechanical interest above the 75th percentile. It would be an economic absurdity to suppose that we could create a revolution in our industrial organization, so that the proportion of workers required for mechanical occupations should conform to our preconceived idea of the proper level of interest for such work.[1]

[1] Nor would we want to make such a change. In counseling for parenthood, we would want to make better parents, not fewer. In counseling for occupational choice, we would want to make better mechanics, taking pride and pleasure in their work, not fewer. Is not the low score for mechanical interest too often an indicator of personal fellings of inadequacy?

Table 1

Distribution of Employed Men and Women, According to Interest Categories of the Kuder Preference Record, Based on U. S. Census Data for 1940

Interest Category	Men	Women
Mechanical	38.0	1.6
Computational	2.5	7.6
Scientific	4.0	0.8
Persuasive	34.7	21.8
Artistic	2.9	6.9
Literary	0.5	1.0
Musical	0.4	1.2
Social Service	2.9	20.7
Clerical	13.6	38.5

In Table 1, we have summarized, according to the interest categories of the Kuder Preference Record, 1940 Census employment data for almost 200 leading occupations (7), embracing about 18 million men and 6 million women. In assigning each occupation to a single field, although two or more categories might appear relevant, the suggestive lists in the manual were followed as closely as possible. In preparing this summary, we omitted occupations in agriculture, in mining, and the merchant marine; the basic table did not include members of the armed forces, urban laborers, or unskilled operative workers. In this way we avoided any overloading of the mechanical category. No assignment could be made for the professional and semi-professional workers who were listed as "not elsewhere classified," but these represent only about 0.7 per cent of all men, and about 0.6 per cent of all women, so that their exclusion does not produce any important distortion.

Table 2 presents similar data from another source, using the interest categories of the Occupational Interest Inventory (5). It is based on a mimeographed publication of the Los Angeles City Schools District (3),

Table 2

Distribution of Men and Women Workers According to Categories of the Occupational Interest Inventory, Based on Los Angeles City Directory of 1940

Interest Category	Men	Women
Personal-Social	13.56	30.0
Natural	1.50	0.30
Mechanical	39.95	16.16
Business	36.75	49.04
The Arts	3.82	3.58
The Sciences	2.99	0.92

which lists the numbers engaged in 400 occupations, according to the Los Angeles City Directory of 1940. The assignment of each occupation to an interest category is made in that listing.

The salient fact which appears from either table is that some fields of work engage so large a proportion of men or women, as the case may be, that it is mathematically impossible for all those engaged to score above the 75th percentile of the general population, in interest for those fields. Other fields employ so small a proportion of workers that, if we assume strength of interest to be an important factor in selection, we must assume that entrants will, as a rule, score far above the 75th percentile.

If we were to base our prediction of success (and satisfaction) solely upon measured interest, we would select a different cutting point for each scale, guided primarily by these employment figures. These cutting points might vary between the 60th percentile and the 95th. However, we would still be faced frequently with the need to interpret interest profiles in which none of the scores reached the cutting points set up. In interpreting such profiles, it would be necessary to make some assumption as to the degree of correlation existing between measured interest and achievement.

It is surely not too pessimistic to assume that this correlation, in any given field, would not be higher than 0.40.* Without any implication that this is a correct figure, we may use it for illustrative purposes. Using conventional regression formulae, we can determine the most probable percentile rank in achievement, to be predicted on the basis of any given percentile rank in measured interest. To do this most easily, we have taken advantage of a published Prediction Table (2), making the necessary conversions between percentile ranks and standard scores. The result appears in Table 3 (where all figures are approximate).

In Table 3, Column 1 gives the interest percentile, and Column 2 the most probable achievement percentile, assuming 0.40 correlation between measured interest and achievement. Columns 3 and 4 give percentile ranks which correspond to the upper and lower limits of the standard error of estimate for this prediction. Hence, an individual whose score for mechanical interest is at the 31st percentile, will most probably attain the 42nd percentile in actual achievement, while in 16 cases out of 100 he will attain the 76th percentile or higher in achievement. At the 76th percentile, he would be excelled in mechanical skill by 24 per cent of the general population, or roughly two-thirds of those engaged in mechanical

* This figure is higher than almost all of the correlations reported in investigations of the relationship between Kuder scores and academic achievement in related fields, as summarized by Super (6). However, it might be argued that these correlations have been attenuated by lack of full reliability in the criteria of achievement. For the soundness of our argument, it is better that we err on the optimistic side.

Table 3

Most Probable Achievement Predicted on the Basis of a Single Interest Measure Whose Correlation with Achievement is Assumed to be 0.40, Together With Points at the Upper and Lower Limits of the Standard Error of Estimate of this Prediction (All entries are percentile ranks)

Measured Interest	Probable Achievement	Plus 1 S.D.	Minus 1 S.D.
1	16	47	3
2	21	55	4
7	27	63	6
16	34	70	9
31	42	76	13
50	50	82	18
69	58	87	24
84	66	90	30
93	73	93	37
98	79	96	45
99	84	97	53

work. If the same young man's score on the literary scale is at the 84th percentile, his most probable literary achievement would be at the 66th percentile, and he has 16 chances in 100 of attaining the 90th percentile—at which point 10 per cent of the general population, or 20 times more than the number employed in literary work (refer to Table 1), will excel him. Hence, if we have only the interest scores and the occupational statistics to guide us, 31st percentile interest in the Mechanical gives a better chance of success than 84th percentile interest in the Literary.

The need for separate cutting points on the different scales can also be shown in another way. If interest is an important selective factor, it must follow that persons engaged in such highly selected fields as literature, music, and the sciences will, in general, make higher interest scores, in their fields, than mechanics or clerks will make in their fields. That is, the average rank of musicians in musical interest must be much higher than the average rank of mechanics in mechanical interest.

This hypothesis can be tested with data that are presented in the Kuder manual, for a variety of occupational groups of men and women. For each of these groups, we are given the mean raw score and standard deviation for each scale, to be compared with similar data for a large "base group," which we shall refer to hereafter as the general population. Assuming normal distribution of the scores of each group on each scale, it is possible to determine the proportion of members of the given occupational group exceeding a given cutting score in the general population. Table 4 states the proportion of members of certain occupational

groups exceeding the 75th percentile on certain relevant interest scales. For example, only 38 per cent of the sample group of mechanics and repairmen exceed the 75th percentile of the general population in mechanical interest, while 98 per cent of the sample group of musicians exceed the same point on the musical scale. A musician with musical interest at the 75th percentile is 2.16 S.D. below the mean for his occupational group, while a mechanic with mechanical interest at the 40th percentile is only 1.37 S.D. below the mean for his occupational group.

Table 4 is a test of the proposal that the 75th percentile shall be used as a cutting point on all interest scales. Using the same data and methods, we can determine new cutting points, by uniformly applying the assumption that the entrant into a given occupation is adequately

Table 4

Proportion of Members of Certain Occupational Groups Exceeding the 75th Percentile on Relevant Interest Scales of the Kuder Preference Record

Occupational Group	Interest Scale	Per Cent above 75th Percentile of Base Group
Men:		
Mechanics & repairmen	Mechanical	38
Manufacturing foremen	Mechanical	49
Aviators	Mechanical	60
Bookkeepers & cashiers	Comuptational	63
Bookkeepers & cashiers	Clerical	65
Salesmen to consumers	Persuasive	66
Securities salesmen	Persuasive	81
H.S. teachers of commercial subjects	Clerical	66
Accountants	Computational	75
Authors, editors, & reporters	Literary	87
Chemists	Scientific	88
Social workers	Social	78
H.S. teachers of English	Literary	93
Musicians & music teachers	Musical	98
Women:		
Sales clerks	Clerical	33
Sales clerks	Persuasive	41
Bookkeepers & cashiers	Clerical	33
Bookkeepers & cashiers	Computational	44
Laboratory technicians	Mechanical	60
Laboratory technicians	Scientific	76
Occupational therapists	Mechanical	74
Artists & art teachers	Artistic	97
Musicians & music teachers	Musical	98.5

Table 5

Base Group Percentiles for Scores at 25th Percentile of Occupational Group Samples, for All Scales on Which There is a Positive Difference Significant at the 1 Per Cent Level. Based on Data in Kuder Manual, Assuming Normal Distributions for All Groups

Occupational Group	Interest Scales and Percentiles
Men:	
Accountants & auditors	78 Computational, 50 Clerical, 42 Literary
Actors	84 Musical, 75 Literary, 50 Artistic
Authors, editors, and reporters	87 Literary, 46 Musical, 40 Persuasive
Chemists	84 Scientific
Clergymen	76 Social, 67 Literary, 45 Musical
Electrical engineers	71 Scientific, 60 Mechanical
Industrial engineers	69 Scientific, 68 Mechanical, 53 Computational
Mechanical engineers	62 Mechanical, 54 Scientific
Lawyers and judges	72 Literary
Musicians and music teachers	96 Musical, 41 Literary
Drugstore managers and pharmacists	50 Scientific, 48 Persuasive
Social workers	78 Social, 43 Literary
National Service Officers of Veterans' Organizations	74 Social
Secondary school teachers	50 Social, 33 Literary
H.S. teachers of commercial subjects	66 Clerical, 35 Computational
H.S. teachers of English	91 Literary
H.S. teachers of mathematics	60 Scientific, 55 Computational
H.S. teachers of social studies	70 Social, 50 Literary
School administrators	60 Social
Meteorologists	63 Scientific, 41 Literary, 38 Mechanical
District supervisors of Vocational Rehabilitation	85 Social
Personnel managers	46 Persuasive, 41 Social, 39 Literary
Aviators	69 Scientific, 68 Mechanical
Draftsmen	57 Artistic, 45 Mechanical
Physical education instructors	74 Social
Radio field engineers	69 Scientific, 55 Mechanical, 50 Persuasive
Weather observers	62 Scientific, 43 Computational, 35 Literary
Retail managers	52 Persuasive
Production managers	45 Mechanical
Sales managers	70 Persuasive
Business managers	40 Computational, 40 Literary, 31 Clerical
Bookkeepers and cashiers	62 Clerical, 60 Computational
Insurance agents and underwriters	62 Persuasive
Securities salesmen	80 Persuasive, 40 Social
Salesmen to consumers	67 Persuasive
Salesmen and agents except to consumers	64 Persuasive, 49 Clerical

Table 5 (Cont.)

Men:	
Mechanics and repairmen	56 Mechanical, 49 Scientific
Manufacturing foremen	58 Mechanical, 45 Scientific
Steel manufacturing foremen	61 Mechanical, 43 Scientific
Women:	
Artists and Art teachers	93 Artistic
Journalists	64 Literary
Home demonstration agents	49 Social
Librarians	63 Literary, 49 Artistic
Musicians and music teachers	93 Musical, 46 Artistic
Physicians	76 Scientific, 51 Mechanical, 48 Social
Primary school teachers	47 Artistic
H.S. teachers of commercial subjects	59 Computational, 53 Clerical
H.S. teachers of English	62 Literary, 39 Musical
H.S. teachers of home economics	36 Artistic, 35 Mechanical
H.S. teachers of mathematics	73 Computational, 51 Mechanical
H.S. teachers of languages	66 Literary
Occupational therapists	74 Mechanical, 65 Artistic, 39 Musical
Trained nurses	52 Social, 42 Scientific
Religious workers	83 Social
Hospital dieticians	46 Scientific
Laboratory technicians	75 Scientific, 64 Mechanical
Tearoom and restaurant managers	51 Computational
Retail buyers	78 Persuasive
Bookkeepers and cashiers	41 Computational
Bookkeepers	56 Computational
General office clerks	40 Clerical, 33 Computational
Personnel clerks	61 Persuasive
I.B.M. operators	61 Computational, 41 Mechanical
Statistical clerks	47 Computational
Stenographers and typists	38 Clerical
Sales clerks	58 Social

suited to it if his measured interest exceeds that of one-fourth of the occupational group. This has been done in Table 5, which states the percentile rank in the base group (general population) for scores at the 25th percentile of the occupational group; this is given for each scale on which there is a positive difference from the base group significant at the 1 per cent level. To facilitate study of this table side by side with the data on which it is based, in the Kuder manual, the original order of listing has been preserved. The reader will observe that there are relatively few instances in which cutting points so determined are as high as the 75th percentile.

Our various Tables reinforce one another in pointing to the danger that lies in assuming that the high points of a profile necessarily point to the most appropriate fields for specialization. "All other things being equal," i.e. without special appeal to inequalities of aptitude tests, even the low average score in one field may give greater chance of success than the high average score in another. If this seems to be suggesting a career of monotony for many workers, let us remember that most men get real satisfaction out of mechanical tinkering, but are given little opportunity to satisfy this interest. The low average score in mechanical work may indeed be analogous to the low average interest of a high-school girl in motherhood. Neither will disqualify the individual from a useful and satisfying career.

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The Kuder Interest Test Patterns of Fire Protection Engineers *

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As a part of orientation testing, the *Kuder Preference Record* is administered to all students entering Illinois Institute of Technology. This inventory is designed to measure the vocational preferences or interests of the individual, and to furnish a ready and objective indication of the type of activity in which he would probably achieve the greatest satisfaction.

These interest scores, together with various achievement and aptitude test scores, are furnished to each counselor so that the freshman student has an appraisal of his interests as well as his ability. Thus, with the counselor, he may plan his career more wisely, selecting the curriculum to which he appears best adapted.

A previous paper[1] has indicated that there are differences in vocational interest, significant at the one per cent level, between students entering engineering studies and those entering non-engineering studies. Similarly, significant differences are also found between students entering different fields of specialization in engineering. These differences are important in the guidance of the student, for it is a basic assumption in the measurement of interests that where ability, opportunity, and effort are equal, the individual will achieve the greatest satisfaction and success in the area where he has the greatest interest.

Our studies of over 1,000 freshmen at Illinois Institute of Technology indicate characteristic and significant profiles for the various groups. The Fire Protection Engineering freshman, however, has a profile which differs from that of other groups primarily because there is no area in which marked interest is exhibited by the group. The profile for the Fire Protection Engineering group is a rather flat one, whereas other engineering groups, and the non-engineering groups such as in Architecture, have profiles with definite peaks and valleys, indicating strong and characteristic interests.

* Read at the 20th Annual Meeting of the Midwestern Psychological Association, St. Paul, Minnesota, May 8, 1948.

[1] Speer, G. S. The vocational interests of engineering and non-engineering students. *J. of Psychol.*, 1948, 25, 357–363.

As we know that graduates of this department enter such different types of work as sales and engineering, it may be presumed that the students enter the department with different goals in mind. Obviously, such students would be likely to have more varied interests than students entering a chemical engineering curriculum. Marked interests of one subgroup might be expected to cancel the lack of interest by another subgroup so that the mean scores of the total group could be expected to approach the average on the scale.

In order to investigate the utility of the *Preference Record* for Fire Protection Engineering students it was felt that the study should be extended to graduates of the department to determine: (1) the kind of work engaged in following graduation, and (2) the interest patterns of the graduates.

Table 1

Percentile Rank of Mean Kuder Raw Scores of FPE Freshmen and Alumni

	FPE Freshmen	FPE Alumni	FPE Alumni*	FPE Sales	FPE Eng.	FPE Adm.
Mechanical	56	64	45	59	75	69
Computational	65	56	77	53	55	65
Scientific	55	49	27	49	56	47
Persuasive	65	88	80	95	77	77
Artistic	50	50	45	54	39	49
Literary	60	55	78	55	53	61
Musical	47	43	62	40	47	43
Social Service	43	53	56	54	64	41
Clerical	39	26	37	23	20	30
N	34	118	14	52	36	30

* Fire Protection Alumni who have left the field of Fire Protection.

With the cooperation of Professor Ahern, Chairman of the Department of Fire Protection Engineering, the *Preference Record* was sent to 198 alumni of the Fire Protection department, who had indicated an interest in the study.[2] Returns were received from 177 of these, and their results may be compared with those of the students. The equivalent Kuder percentiles of the mean raw scores of these two groups are shown in Table 1.

When we compare the scores of the Fire Protection students with the scores of the alumni still in Fire Protection work, certain differences in

[2] Guilford and Martin's *Personnel Inventory I* was also administered to the alumni, but was not given to the students. No appreciable differences were found between the sales, engineering, or administrator groups on any of the scales of Objectivity, Agreeableness, and Cooperation. All three of the groups had mean C-scores of 6 on Objectivity and Cooperation, and 5 on Agreeableness.

interest become apparent. These data are given in Table 2. The alumni show a significantly greater interest in persuasive and social service activities, and significantly less interest than the students in clerical activities. Other differences shown in Table 2 are not statistically significant.

A small number of the alumni who returned the questionnaire indicated that they have left the field of Fire Protection work, and have entered other types of activity such as banking, merchandising, and personnel. Although this number is small, only fourteen, the interest patterns of this group were compared with the alumni still active in Fire Protection. The scores of the two groups, shown in Table 1, indicate very striking differences in preference. Those alumni who are no longer in Fire Protection work exhibit much greater interest in computational,

Table 2

Raw Kuder Scores of FPE Students and Alumni

	Freshmen		Alumni			
	Mean	σ_M	Mean	σ_M	D_{M1-M2}	D/σ_D*
Mechanical	83.0	3.25	86.5	1.48	3.5	—
Computational	38.4	1.96	35.9	1.07	2.5	—
Scientific	70.5	2.10	68.3	1.25	2.2	—
Persuasive	71.2	3.05	84.6	1.84	13.4	3.76
Artistic	46.8	2.10	46.5	1.76	.3	—
Literary	49.9	2.71	47.9	1.61	2.0	—
Musical	16.0	1.32	15.3	.81	.7	—
Social Service	58.7	1.63	65.4	1.51	6.6	3.0
Clerical	50.3	1.65	43.5	1.43	6.8	3.1
N	34		118			

* Only ratios of 3.0 or larger are shown.

literary, musical, and clerical activities, and much less interest in mechanical and scientific activities than those still in the field. Similar differences are found when this group is compared with the freshmen students, as shown in Table 1. The alumni no longer in Fire Protection work express less interest in mechanical and scientific activities and more interest in computational, literary, and musical activities. They also express more interest in persuasive and social service activities than do the freshmen.

The alumni who are now in Fire Protection Engineering work also indicated whether their work is primarily sales, engineering, or administrative in nature. The scores of these three subgroups are also shown in Table 1.

Although all three of the alumni groups are higher in persuasive interest than the student group, the salesmen are much higher on this

scale than the other two. Both the sales and the engineering alumni groups have higher social service interests than the students or the administrators, and also lower computational and clerical scores. In mechanical interest the sales alumni do not differ significantly from the students, although the administrators are considerably higher, and the engineer group is still higher.

In short, the average freshman student in Fire Protection Engineering is less scientific in interest than other student engineering groups at Illinois Institute of Technology, and exhibits no really strong preferences for any of the areas measured, though his clearest interest is in working with figures and with people. The alumnus who is now in sales work is no more scientific in interest than the student, but has a much greater interest in working with people, and a somewhat greater interest in work which is of benefit to others. The alumnus now in engineering work has a greater interest than the students in working with people, and a stronger interest in work which will be of benefit to others. Although apparently no more scientific in interest than either of the other alumni groups or the students, he has a stronger interest in work which concerns machines and mechanical activities.

The alumni administrator group differs the least from the average Fire Protection Engineering freshman, showing only somewhat higher interest in mechanical and persuasive activities.

In attempting to evaluate these results in order to use them more effectively in the guidance of students, there arises the problem of determining whether the alumni entered sales or engineering because the individuals were the kinds of persons indicated by these scores, or whether they developed these interest as a result of the type of work which they were doing.

Although the groups are too small to permit definite conclusions, we felt that some evidence on this point might be obtained by comparing the scores of the alumni who had been employed for varying periods of time. Here it was necessary to depend upon the date of graduation as an indication of the length of employment in these fields. This is probably sufficiently accurate for the sales and engineering groups, but is probably not accurate for the administrator's group, as most people do not obtain managerial responsibilities until after a period of employment in other capacities.

For each of the alumni groups, the scores were arranged in order of the date of graduation, and arbitrarily classified by four dates: those who had graduated between 1910 and 1919, 1920 and 1929, 1930 and 1939, and since 1940. Ideally, such data should represent a series of measures obtained from the same persons over a period of time, rather than the

cross-sectional approach used here. The latter method, though less desirable, is used of necessity.

The artistic and musical scores on the Preference Record are relatively constant for the three alumni groups, and do not differ greatly from the student scores. The literary scores for Engineering and Administrative alumni show little change, but the sales group exhibits a marked decrease in literary interest for the older alumni. The computational and clerical interests differ from the scores of the students, as shown above, but with one exception do not show any consistent trends within the three alumni groups. An exception is the rating on clerical interest of the alumni now in sales work where there is found a steady increase in clerical interest the longer the individual has been a graduate.

Table 3

Date of Graduation and Kuder Percentiles of FPE Alumni in Sales, Engineering, and Administration

Activity	Date of Graduation	Kuder Scales								
		Mec.	Comp.	Sci.	Pers.	Art.	Lit.	Mus.	Soc.	Cler.
Sales	1920–29	51	53	45	95	50	43	40	65	36
	1930–39	59	55	52	95	58	55	37	50	20
	1940–46	71	25	31	94	51	80	57	20	14
Engineering	1920–29	88	36	65	78	70	70	30	77	23
	1930–39	79	75	58	65	30	55	55	75	20
	1940–46	65	55	47	85	42	50	42	50	29
Administrative	1910–19	50	88	59	52	36	67	42	39	36
	1920–29	65	65	43	72	61	67	55	35	35
	1930–29	78	67	59	90	61	54	42	39	45

The differences in score on mechanical interest are shown in Table 3. The sales group shows only minor and unimportant differences in this score, but both the administrators and the engineers exhibit definite changes. The engineers indicate a marked increase in mechanical interest, while the administrators show an equally sharp decrease in such interests.

The engineers show a steady increase in interest in scientific activities. The differences found for the administrators do not reflect a consistent change. The scores of the sales groups, however, seem to indicate some trend toward an increase in scientific interest.

In all three of the age groups the salesmen have exceptionally high persuasive scores. The engineers begin with lower scores than either the salesmen or administrators, and show a declining trend the longer they

have been employed in that occupation. The administrators show a sharp and steady decrease in such interests.

In social service interest, the administrators are low at all age levels, but both salesmen and engineers show a steady increase, with the rate of increase somewhat sharper for the salesmen than for the engineers.

To summarize, it seems probable that the freshman students in Fire Protection Engineering are a more heterogeneous group than the students in other departments. Those students who continue in Fire Protection work tend to enter one of two rather different types of activity, sales or engineering, although the sales work in this field is frequently closely related to engineering. About one-third of them may look forward to administrative responsibilities beginning ten years after graduation.

Those with very high persuasive and very low scientific and social service scores tend to enter sales; those with high mechanical, scientific, and social service scores, and low persuasive scores tend to enter engineering activities. Those with high computational, literary, musical, and clerical interests and low mechanical and scientific interests tend to leave the Fire Protection field to enter other occupations. From these results it also appears that those who later achieve administrative responsibility quite quickly approach the average in each of the interest areas measured.

Recognizing again that the results must not be considered too definite because of the small numbers involved, it may nevertheless be possible to draw some tentative conclusions from these data. We conclude, then, that for guidance purposes the *Preference Record* is a useful instrument.

A second conclusion is that the *Preference Record* appears to be sensitive to life experiences of the individual, so that the interpretation of scores must consider both his present stage of development, and a static job profile, in relation to possible changes in the interest pattern.

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Certain Factors Bearing on the Cleeton Vocational Interest Inventory

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This paper treats certain factors which ought to be taken into consideration in any future evaluation of the Cleeton Vocational Interest Inventory.[1]

Procedure

The inventory was administered to 166 twelfth grade high school boys at the beginning of a semester. One of the directions for marking the 630 items requires that the subject place a plus sign beside the item he likes or would answer "yes" and a zero sign beside the item he dislikes or would answer "no." Fifteen weeks later, the inventory was again administered to the boys. From the original responses and the digressions from them on the second administration, certain data were obtained.

Findings

1. *The number of pluses and the number of zeros marked on the first administration tended to balance.* The following totals for each type of response were obtained.

All responses	104,580
Pluses	51,912
Zeros	52,617
Blanks	51

It appears from the above figures that about equal opportunity exists for plus and zero responses to be made. Whether this is a chance or foreseen phenomenon peculiar to the instrument is not known. No doubt, it is a desirable characteristic in that it tends to allow a reasonable number of both types of responses in any given situation. Moreover, it is unlikely that any given individual will make only one type of response.

2. *Five one-hundredths (0.05) per cent of all responses by all the boys on the first administration were left blank* (from preceding figures). It would

[1] Cleeton, Glen U., *The Cleeton Vocational Interest Inventory*, Men, McKnight and McKnight, Bloomington, Illinois, 1937; revised edition, 1943. This study is based on the original edition which differs from the revised in internal construction in that it contains one less category of "vocational interests." It is not concerned with the SR section which has been omitted in the revision.

appear, therefore, that the requirement for only plus or zero responses is justifiable if the criterion of readiness to respond either positively or negatively is used. However, it must be stated in this connection that instructions were expressly given that either response was to be used. If a third alternative had been suggested, the figures might have been quite different. Instances of complaints did occur because certain boys thought that a mark for an indifferent attitude should be allowed.

3. *A 21.4% change occurred in the responses of the boys after 15 weeks.* Cleeton[2] has reported a 6.1% change by unspecified individuals within a month. As will be observed, the results of the present investigation are far greater than this figure although, of course, the time lapse between administrations is greater in the present study.

In individual cases, high percentage change of all responses did not necessarily change the preferred category[3] of "vocational interests." One case is here cited.

Case X

Total change was 35%. Point score in the preferred category, mechanic (MEG), initially was 48; point score rose to 49 in the same category which was also the preferred one on the second administration. Mechanical interests, as estimated by the inventory, persisted though percentage change of responses to the 630 items was great.

Table 1

Number and Per Cent of Cases Preferring Certain Categories

	First Administration				Second Administration			
	No.		%		No.		%	
Mechanic (MEG)	75	127	45	76	75	124	45	75
Engineer (EFC)	52		31		49		30	
All others (7 Categories)	39		24		42		25	
Totals	166		100		166		100	

In the less obvious cases, it would have taken an experienced analyst to detect a similarity of interest patterns, if similarity existed,[4] on both administrations. By and large, however, the preferred category was affected when large percentage change of total responses occurred.

[2] Cleeton, Glen U. *Manual of Directions for Vocational Interest Inventory.* McKnight and McKnight, Bloomington, Illinois, 1937, p. 21.

[3] "Preferred category" in this and subsequent references means that category in which the subject had made his highest point score. It does not refer to highest percentile rank which has been assigned to norms in the later edition.

[4] The question whether interest patterns actually changed is beyond the scope of this paper.

4. *About three-fourths of the preferred categories were either the mechanic (MEG) or engineer (EFC) on both administrations.*

From the data in Table 1, it appears that the inventory had segregated the extreme likes of these boys consistently as a group. What the results would be in another locality where the vocational make-up of the community would be quite different is, of course, not known nor can they be ascertained from the norms furnished in the original or revised manual.

5. *When a change of preferred category took place, the mechanic (MEG) and the engineer (EFC) interchanged more readily than any other.*

Table 2

Number and Per Cent of Cases Retaining and Shifting Preferred Category

				Second Administration					
				EFC		MEG		All Others	
		No.	%	No.	%	No.	%	No.	%
First Administration	EFC	52	100	36	70	10	19	6	11
	MEG	75	100	12	16	59	79	4	5
	All Others	39	100	3	8	5	13	31	79

The data in Table 2 should be read as follows: Of 52 boys initially preferring the engineer (EFC) category, 36 or 70% retained that category as the preferred one on the second administration; 10 or 19% shifted to the mechanic (MEG); and 6 or 11% shifted to other categories. It should be stated that the number of cases preferring other than the two categories named was insufficient from which to draw any conclusion.

Tabel 3

Change of Response to Initially Liked Occupation Occurring in Selected Combinations of Items

Combination	No. of Pluses	No. Changed	% Changed
Three Most Liked Occupations in High Category	498	30	6.02
Other Liked Occupations in High Category	1591	371	23.32
Liked Occupations in Other Seven Categories (excluding high and low)	7766	2578	33.19
Liked Occupations in Low Category	590	256	43.49

6. *More reliance can be placed on the three most liked occupations in the highest scoring category than on any other combination of liked occupations analyzed from the point of view of constancy of response.*

From the figures in Table 3 one notes a progressive increase in percentage change. Within the limitations imposed by the grouping of the middle seven categories, we can say that the classification of occupational items in the respective categories appears justified on the basis of degree of change to be expected. From the point of view of the counselor, more reliance can be placed on the three most liked occupations in the highest scoring category than on any other combination of liked occupations.

Limitations

The results involving change of responses after fifteen weeks may be somewhat colored by the fact that some of the boys investigated information about certain occupations listed in the inventory. Certain responses on the second administration were affected by such study but the exposure to such information, under the circumstances existing in this investigation, would hardly influence the larger results encompassed in this paper to a marked degree.

Another factor limiting the study is that point score rather than percentile rank of score was used in isolating the preferred category. The 1943 norms show that the two indices do approximate each other but undoubtedly the latter is to be preferred.

Summary

The data presented show both favorable and unfavorable phenomena in connection with the use of the Cleeton Vocational Interest Inventory with twelfth grade boys. From the responses on the first administration, the data appear favorable as to the scope of the items included in the inventory. The requirement that only plus or zero responses be made did not always satisfy the subjects used in this study although only a negligible percentage of the items were left blank. From the figures involving change after fifteen weeks, results are somewhat mixed. Certainly a change of about one-fifth of the responses leaves much to be desired as to the stability of attitudes toward the items in an inventory purporting to "measure vocational interests." At the same time, large change of all items does not appear in all cases to change the preferred category. Where it did, an experienced analyst might have been able to detect similarity of interests, if similarity existed, on both administrations. The inventory seemed to segregate the extreme likes rather consistently but the evidence in this study permits this to be said only for

the mechanic (MEG) and engineer (EFC) categories. Considerable reliance can be placed on the most liked occupations in the preferred category from the standpoint of the likelihood that plus responses will occur again on a subsequent administration.

The above conclusions must necessarily be viewed within the conditions and limitations of the study.

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A Study of Stage Fright and the Judgment of Speaking Time *

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This study had its origin in the statement often made by students that time seems so long when they are speaking, especially if they are somewhat afraid; that a brief pause seems minutes long, etc. The purpose of this study was to see whether there is any significant difference between the judgment of elapsed time when a person is speaking and when he is not and if the judgment of length of speaking time is influenced by the degree of stage fright.

Procedure

Part A: To check on whether or not college students think there is a correlation between degree of stage fright and judgment of speaking time, seventy-five of them were asked to select the one of the three following statements which, in their opinion, was closest to correct. "When a person is speaking

1. The more afraid he is, the longer his speaking time will seem to him.
2. His fear will have no influence on how long the time he speaks seems to him.
3. The more afraid he is, the shorter his speaking time will seem to him."

On another day, the same students were asked similar questions with the substitution of "less afraid" for "more afraid" in questions 1 and 3 and with the order of presentation reversed.

Part B: One hundred and ten students in six sections of Fundamentals Speech, not including any of those who took part in Part A, guessed the length of a period of time during which they sat doing nothing. The time was changed for each section (40, 50, 60, 75, 80 and 90 seconds) so no group would profit from the experience of any other group. Then each student gave an impromptu speech on a subject which was handed him typed on a card and left face down until the speaker preceding him began to talk. The speech subjects were statements from Aesop's

* The original data for this study were collected at the University of Colorado. Analysis of these data was a part of the research program of the Speech Clinic (Office of the Dean of Students) of the University of Minnesota.

Fables, such as "Look before you leap," "A stitch in time saves nine," etc. After each speaker had talked, he guessed his speaking time in seconds. He also indicated his stage fright on a scale from 1, indicating no stage fright, through 10 indicating very great stage fright.[1]

The experimenter kept a record of the actual speaking time, measuring it with a stop watch. A comparison of the amount of error made in judging the speaking and the non-active periods was made. Since the number of persons in some of the ten levels of stage fright was small and since the purpose of this study was to study a trend, a grouping was made on the basis of extremes. This was done as follows: Group 1: Below average stage fright (those who checked 1 through 4); Group II: Average fright (those who checked 5 through 6); and Group III: Above average fright (those who checked 7 through 10).

Results

Most students (95%) believe that there is a positive relationship between the intensity of a person's stage fright and the length of time he will believe has elapsed during a speech he has given. The more afraid he is, the longer the time will beem to him; the less afraid he is, the shorter the time will seem to him. Table 1 reveals this situation and also shows

Table 1

Students' Responses to Stage Fright Questionnaire

		Second Presentation				
	Response*	1	2	3	Total	Per Cent
First Presentation	1	71			71	94.6
	2		2		2	2.7
	3			2	2	2.7
	Total	71	2	2	75	
	Per cent	94.6	2.7			100

* Response 1 = The more afraid a person is, the longer his speaking time will seem; 2 = Fear has no influence on how long speaking time will seem; and 3 = The more afraid a person is, the shorter his speaking time will seem.

the consistency with which students make these judgments in responding on two different days to the two forms of the questionnaire.

Table 2 indicates that the students in this experiment tend to judge a "non-active" period as longer, rather than shorter, than it is and, in contrast, they tend to judge their speaking period as shorter, rather than longer, than it is. Sixty of the 110 students overestimated the length of

[1] Henrikson, E. H. Some effects on stage fright of a course in speech. *Quart. J. Speech*, 1943, 29, 490–491.

Table 2

Students' Error in Time Judgments

Per Cent of Error	Number Misjudging Inactive Time			Number Misjudging Speaking Time		
	Over-estimate	Under-estimate	Total	Over-estimate	Under-estimate	Total
130.01–140	2	0	2	0	0	0
120.01–130	0	0	0	0	0	0
110.01–120	3	0	3	0	0	0
100.01–110	0	0	0	0	0	0
90.01–100	3	0	3	2	0	2
80.01– 90	1	0	1	2	4	6
70.01– 80	4	0	4	2	6	8
60.01 –70	3	2	5	0	8	8
50.01 –60	3	4	7	1	10	11
40.01 –50	6	2	8	1	17	18
30.01 –40	7	3	10	2	15	17
20.01 –30	11	11	22	0	9	9
10.01 –20	14	11	25	9	12	21
.01 –10	3	10	13	3	5	8
No error			7			2
Total	60	43	110	22	86	110

the inactive period but only 22 of the 110 students overestimated the length of the speaking time.

The students' error in judging their speaking time (mean 39.0% ± 7.7%) is slightly larger than their error in judging the non-active period (mean 36.1% ± 8.4%) but the difference is not statistically significant (C.R. = .715) (see Table 3). The percentage of error in judging the length of a period of time, whether non-active or speaking, is not influenced significantly by degree of stage fright. Judging speaking time, those least afraid (Group 1) made a mean error of 38.5% ± 21.0% while those most afraid (Group 3) made a mean error of 36.2% ± 12.9% (C.R. = .4). Judging the inactive period, the same groups made mean errors of 35.8% ± 44.0% and 35.1% ± 16.% with a C.R. of .09. Neither difference is significant.

More students (27%) of the group with little stage fright (Group 1) tend to overestimate the length of their speaking time than do those with greater stage fright (18%) (Group 3). This difference is not statistically significant (C.R. = .87). Thus, the experimental findings are not in accord with the students' expressed beliefs.

Table 3

Comparison of Students' Judgment of Speaking Time and Inactive Time as Related to Their Degree of Stage Fright

Own Rating of Degree of Stage Fright	Number of Cases	Judgment of Speaking Time				Judgment of Inactive Period			
		Mean Per Cent of Error and S.E. of Mean in Estimation	Per Cent of Students			Mean Per Cent of Error and S.E. of Mean in Estimation	Per Cent of Students		
			Overestimating	Underestimating	Errorless		Overestimating	Underestimating	Errorless
Below Av. (1–4)	26	38.5%±21.0%	27%	73%	0%	35.8%±44.0%	54%	38%	8%
Average (5–6)	34	43.0%±13.7%	18%	82%	0%	38.0%±25.0%	59%	41%	0%
Above Av. (7–10)	50	36.2%±12.9%	18%	78%	4%	35.1%±16.0%	52%	38%	10%
Total	110	39.0%± 7.7%	21%	77.7%	1.3%	36.1%± 8.4%	55%	39%	6%

Summary

Under the conditions described and within the limits indicated, most students (95%) believe that the more afraid a student is, the longer his speaking time will seem to him. The experimental results, however, indicate that persons of all degrees of stage fright may make errors in judging a period of time, whether they make the judgment while they are speaking or while they are sitting doing nothing. But there is no significant tendency for degree of stage fright to correlate positively with an estimation of speaking time, as the students in this study thought would be the case. The tendencies which emerged were actually in the opposite direction.

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Cumulative Effect of Marginal Conditions Upon Rate of Perception in Reading *

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Various environmental factors may influence speed of perception in reading. Some typographical arrangements foster a rapid rate of perception, other arrangements retard the rate. Illumination is another important factor. The intensity of illumination must be above a certain level or speed of perception in reading will be retarded. A marginal condition is here defined as one in which the rate of perception in reading is not significantly retarded, but would become so with further changes of the condition in an adverse direction. If several of these marginal conditions are present, do the effects cumulate to produce a significant retardation in rate of perception in reading?

Paterson and Tinker (1) show that italic printing retards speed of reading by 2.7 per cent. This is not a statistically significant difference. They also report (page 81) that 8 point type is read 3.4 per cent slower than an optimal size (10 point). This also is not a significant difference. Tinker (2) found that, with adequate adaptation of the eyes, illumination intensities below about 3 foot-candles retarded speed of perception in reading 10 point type. The rate did not change for 3 foot-candles and above. Apparently the critical or marginal level of illumination for reading 10 point type is approximately 3 foot-candles.

It is of theoretical and practical interest to know the result on speed of perception in reading of combining these three marginal conditions, i.e., 8 point type with italic printing to be read under 3 foot-candles of light. The problem of this study, therefore, is to investigate the effect upon speed of perception in reading of combining three marginal conditions: illumination intensity, type form, and type size.

Materials and Procedure

The reading material consisted of Forms I and II of Tinker's Speed of Reading Test.[1] In each form there are 450 paragraphs (items) of 30 words each. As a check on comprehension, the reader crosses out the

* The writer is grateful to the Graduate School, University of Minnesota, for research grant to finance this study.

[1] This test is not yet available for general distribution.

one word that spoils the meaning in each item. The two forms are approximately equivalant.

The experiment was conducted in a light laboratory. The illumination was indirect and thus well diffused. There were two groups of subjects: the control and the experimental group. For the most part, two subjects were tested at a time: the first two were in the control group, the next two in the experimental group, and so on. There were 83 subjects in each group.

With the control group, the procedure on arriving at the laboratory was as follows: a light intensity of 25 foot-candles was provided. The subject was adapted to the light for 3 minutes while a preliminary drill exercise was given to familiarize him with the test procedure. Then the standard set-up of Form I of the test was given with a 10 minute time limit. The standard set-up was 10 point roman, Excelsior type face, set with two points of leading in a 20 pica line width on eggshell paper stock. Then after a 15 minute rest, Form II was given with a 10 minute time limit. Typographically, Form II was the same, as Form I in this (control) group. Use of the control group makes it possible to correct the means in the experimental group for amount of inequality in difficulty between Forms I and II.

Testing procedure for the experimental group was as follows: on arrival at the laboratory the subjects were adapted for 3 minutes to the 25 foot-candles of illumination and given the practice exercise. They were then given the standard set-up of Form I, just as with the control group. The subjects were then adapted to 3 foot-candles of light for 15 minutes while resting. Then they were given Form II of the reading test set-up as follows: 8 point italic, Excelsior type face, one point leading in a 12 pica line width on eggshell paper stock. One point leading is adequate for 8 point in this line width (1). The time limit was ten minutes as in all the other testing. In every instance the subjects were instructed that it was a test for speed and accuracy, and to work rapidly but not make mistakes. There was, therefore, a strong emphasis upon speed of response. Some unpublished work done by the writer indicates that the speed attitude in reading can be maintained at a high and constant level for a 10-minute interval.

Results and Discussion

The data of this experiment are given in Table 1. Test Group I is the control and Group II the experimental group. In column 8 is the correlation between Forms I and II. These coefficients of .94 and .95 indicate very high equivalant form reliability for the reading tests. In Test Group I, Form II, which is identical typographically with Form I and which was read under the same illumination as Form I, was read

Table 1

Cumulative Effect of Marginal Conditions Upon Speed of Perception in Reading

Test Group	Test Form and Type Size	Foot-Candles	Mean: Paragraphs	SE_M	Differences Between Means in: Paragraphs*	Per Cent	r	D / SE_{DIFF}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I	I, Roman 10 Pt.	25	118.75	2.40	0.00	0.0	.95	0.00
	II, Roman 10 Pt.	25	117.57	2.74				
II	I, Roman 10 Pt.	25	118.53	2.49	12.29	10.4	.94	14.43
	II, Italic 8 Pt.	3	105.06	2.34				

* The differences in column 6 are "corrected" by the amount of the difference between the mean scores of Form I and Form II of Test Group I which serves as a control group. The "correction" amounts to 1.18 paragraphs.

1.18 paragraphs slower than Form I. This serves as a "correction" for the differences listed in column 6 of the table. Incidentally, the difference of 1.18 is not statistically significant. In Group II is shown the combined effect of the marginal conditions (8 point italic type read under 3 foot-candles of light) in comparison with the standard arrangement (10 point roman type read under 25 foot-candles of light.) The speed of perception in reading was much slower with the marginal conditions operating together. Thus the 8 point italic with 3 foot-candles of light was read 12.29 paragraphs slower than the standard set-up. In other words, 369 fewer words were read in the 10 minute period. This amounts to a difference of 10.4 per cent. The critical ratio in column 9 reveals that this difference is significant beyond the one per cent level.

Apparently when these three marginal conditions are all present at the same time they produce a non-optimal visual situation which is not produced by any one of the three alone. Thus neither 8 point type, italic print nor 3 foot-candles illumination significantly retard speed of perception in reading.[2] But in combination they produce a retardation of over 10 per cent. This amount of retardation is only achieved by marked degrees of non-optimal printing arrangements or by reducing illumination to less than one-tenth of a foot-candle.

The implications of these finding for the hygiene of vision in the reading situation are clear. It is not safe to use the critical level of

[2] These results were obtained from reading periods of 1¾ minutes. There is a possibility that a longer reading period might have produced a significant difference. It is doubtful, however, that such a difference would be as large as 10 per cent.

illumination in visual situations where the details to be discriminated are also marginal. A combination of marginal conditions such as used here work together to produce markedly non-optimal visual performance. This has been shown to be true for reading 8 point italic print under 3 foot-candles of light. It remains to be seen whether similar results occur with other combinations.

These results emphasize a point stressed previously by the writer. Critical (marginal) levels of illumination should not be employed for visual tasks. The intensity of light should be enough greater than the critical level to assure an adequate margin of safety, i.e., so that the visual task may always be done without loss of efficiency and with comfort.

Summary

1. The purpose of this study was to investigate the effect upon speed of perception in reading of combining three marginal conditions: illumination intensity, type form and type size.

2. Eight point italic type was read under 3 foot-candles of light in comparison with reading 10 point roman type under 25 foot-candles. When employed as a single variable, neither 8 point type, italic type form, nor reading under 3 foot-candles retards speed of reading significantly.

3. The 8 point, italic print, read under 3 foot-candles retarded speed of perception in reading by 10.4 per cent in comparison with reading 10 point Roman type under 25 foot-candles.

4. Thus these three marginal conditions, when operating together, produce a markedly non-optimal visual task.

5. To maintain a hygienic visual environment, therefore, it is important not to employ marginal (critical) levels of illumination. An adequate margin of safety above the critical level is needed.

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Similarities and Differences in College Populations on the Multiphasic *

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In a routine testing program the Minnesota Multiphasic Personality Inventory (MMPI) was administered to 542 General College Freshmen at the University of Minnesota in the fall of 1945. In interpreting the scores or profiles of individuals in this population it was important to know whether this normal population of General College Freshmen should be considered as a sample of the original normal population on which the MMPI was standardized, or if it was a population which was significantly different from this original norm group.

In order to determine if this significant difference existed, and also to determine if college populations differ significantly among themselves in their uncorrected K scores on the MMPI, the Means and Standard Deviations of the General College population were compared with the Means and Standard Deviations of other College populations on which data were available. The group-profiles were compared to see if there was any similarity of pattern in MMPI profiles in college groups. Finally the chi-square test of significance was used to see if the number of General College students who had deviate scores on the MMPI was significantly different from the number expected by the authors of the MMPI in the general population.

College Populations

The following brief descriptions of the college populations, for which test scores on the MMPI were available, indicate the different selection factors operating in each group.

Original "College Normal." According to Meehl (7) and McKinley and Hathaway (6), in the construction and development of the scales for the MMPI it was found necessary to take special precautions with respect to college persons. Throughout the Inventory there were certain items on which the responses, which would discriminate the normal person from the abnormal, would also discriminate between the college person and the normal person. Because of the necessity of eliminating these items from the test, a number of college and pre-college students were used as a control group in the selection of items to avoid inconsistent differentiations ascribable to differences in marital or parental status, age, socio-economic status, intelligence, and education.

This college group was called "college normal." It was composed of 155 males and 110 females, mainly pre-college high school graduates, who had

* This paper is a revision of part of the writer's Ph.D. thesis.

Table 1

Means and Standard Deviations on MMPI Scales of College Populations*

College Populations		MMPI Scales								
		Hs	D	Hy	Pd	Mf	Pa	Pt	Sc	Ma
Original College Male (N = 155)	$\bar{X}$	47.44	45.60	51.56	44.76	Not	48.11	46.58	47.29	48.54
	σ	5.88	8.85	7.31	9.87	Given	7.36	8.08	7.48	10.05
College Industrial Male (N = 66)	$\bar{X}$	46.51	49.77	52.88	52.35	53.50	52.80	46.05	45.68	56.36
	σ		not reported							
Torrens Students Male (N = 82)	$\bar{X}$	43.73	49.98	53.56	48.29	55.06	51.33	46.29	45.85	49.71
	σ	3.78	8.31	6.31	9.64	9.41	7.11	7.32	5.73	8.16
General College Male (N = 176)	$\bar{X}$	53.70	54.87	56.83	54.87	56.12	53.60	52.43	52.85	58.71
	σ	10.33	11.63	9.87	10.33	6.05	10.09	9.61	9.89	10.48
Original College Female (N = 155)	$\bar{X}$	45.41	45.80	49.87	45.68	Not	49.46	44.86	47.48	48.04
	σ	8.48	8.11	9.86	8.35	Given	7.89	7.76	7.39	10.84
Loth Soph. Students Female (N = 110)	$\bar{X}$	44.64	47.94	52.00	48.84	51.78	49.88	48.72	48.88	52.58
	σ	5.68	8.67	6.96	9.77	9.47	8.31	8.36	7.95	9.32
Lough Students Female (N = 185)	$\bar{X}$	47.10	48.40	52.70	49.70	50.30	52.20	48.70	51.40	54.60
	σ	7.98	9.42	9.05	11.16	9.25	8.69	9.21	9.27	10.14
General College Female (N = 366)	$\bar{X}$	46.69	49.93	52.97	53.84	53.03	52.23	48.25	49.22	54.73
	σ	7.04	8.73	7.71	8.84	9.50	8.48	8.35	7.88	9.60

* K correction was not applied (7, 8).

come to the University Testing Bureau for pre-college guidance, plus a number of representatives from college classes. They represented an adolescent, unmarried group, with a "preferred" rating as to intelligence, socio-economic status, and education. Since the builders of the MMPI were not interested at the time in these "college normals" other than as an aid in item selection, little further attention was given to the data on their scores, except as they were used to eliminate the items previously mentioned.

College Industrial. A group of 66 college graduates employed in an industrial concern. These were reported from Dr. Starke R. Hathaway's files.

Torrens Group (9). 82 junior medical students who had taken the MMPI while serving their neuropsychiatric clerkship at the University. These scores were made available by Dr. Hathaway.

Loth Group (4). 110 female students enrolled in the elementary psychology laboratory course at the University of Minnesota in the Fall quarter, 1943.

Lough Group (5). 182 female Teachers College students in New York State.

General College Population, University of Minnesota. The test was administered to 176 males and 366 females who entered the General College in the

fall quarter 1945. Six weeks had elapsed since registration so the students had become oriented to college. The full-tide of veteran enrollment had not then reached the University as only 10% of the 1945 General College freshmen were veterans.

In general, the student attends the General College, rather than some other college in the University of Minnesota, or elsewhere, because: (1) he has been unable to meet the scholastic requirements of another college; or (2) certain deficiencies in his high school record need to be made up; or (3) he wishes to secure a general education for two years. Transfer to another college at the end of two years is possible for some of the better students. Table 1 gives the Means and Standard Deviations of each population.[1] The group profiles based on these data are shown in Figures 1 and 2.

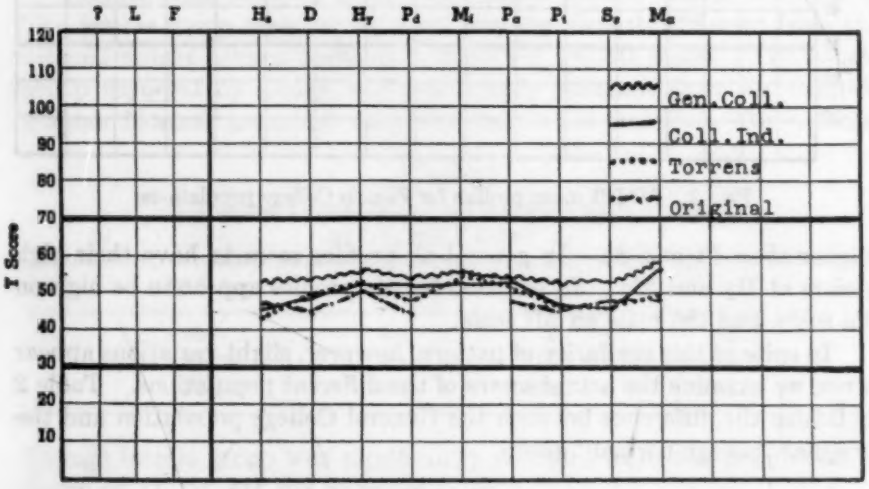

FIG. 1. MMPI mean profiles for Male College populations.

An examination of the mean scores and profiles indicates that although there are marked differences in elevation, there are certain similarities in the patterns of the Group profiles. The neurotic triad (Hs, D, Hy) indicates that, unlike the abnormal profile where D is usually the high point, these college profiles have Hy higher than Hs and D. On seven of the eight profiles Hs, D, and Pt are below the mean of the general population. The one exception is the General College male group. It is the only group with the average score on the Hs scale above the mean of the general population. Since young people as a whole do not ordinarily show this hypochondriacal tendency, this General College male population may differ slightly, psychologically from the other groups studied.

On only one profile is the Hy score below the mean of the general population, but it is still the high point of the neurotic triad. On six profiles Sc and Pt are below the mean. On eight profiles Pa and Ma are

[1] The summaries of data are taken from Brown (1).

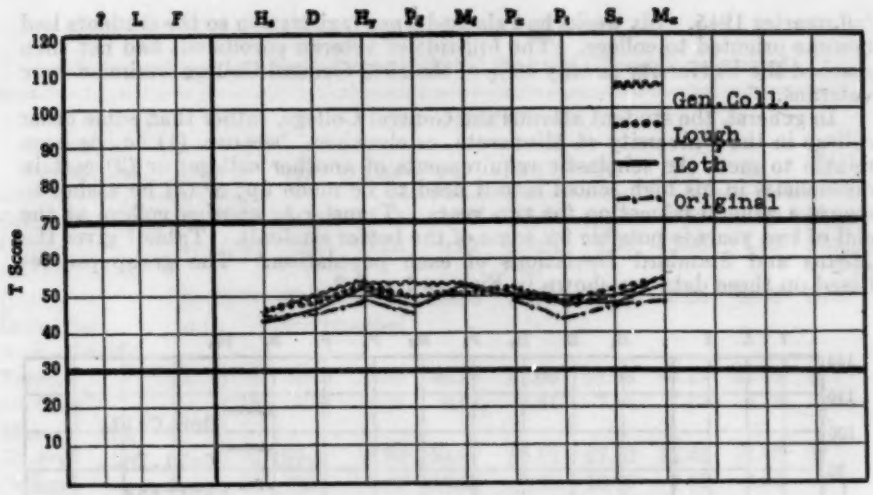

FIG. 2. MMPI mean profiles for Female College populations.

higher than Pt and Sc. In general all profiles seem to have their high points at Hy and Ma. In addition female profiles appear to be high on Pa scale, and the male on Mf scale.

In spite of this similarity of pattern, however, slight variations appear when we examine the actual scores of the different populations. Table 2 indicates the difference between the General College population and the original "college normal" group.

Table 2

Differences in T-Score Units Between the Means of General College Populations and the Original College Group

	Hs	D	Hy	Pd	Mf	Pa	Pt	Sc	Ma
Male									
N = 176									
G. C.	53.70	54.87	56.83	54.87	56.12	53.60	52.43	52.85	58.71
Orig.	47.44	45.60	51.56	44.76	a	48.11	46.58	47.29	48.54
Diff.	6.26*	9.27*	5.27*	10.11*	a	5.49*	5.85*	5.56*	10.17*
Female									
N = 366									
G. C.	46.69	49.93	52.97	53.34	53.03	52.23	48.25	49.22	54.73
Orig.	45.41	45.80	49.87	45.68	a	49.46	44.86	47.48	48.04
Diff.	1.28	4.13*	3.10*	7.66*	a	2.77*	3.39*	1.74	6.69*

a. not given

* difference significant at the 1% level.

The General College male population was significantly different (1% level)[2] on all scales. The female group was significantly different on all scales except Hs and Sc.

The validating scores (?, L, F) were not compared. Because of the arbitrary assignment of T-score values to these scales, the usual tests of the significance of the differences could not be employed. The *percentage* distribution for General College students on the ?, L, and F scales, as given in Table 3, would not seem to indicate any significant difference from the distribution expected by the authors of the MMPI (3, 8).

Comparisons between other populations showed similar differences. The female group reported by Loth was significantly different from the original college normal population on D, Pd, Pt, Ma scales. The female group reported by Lough was significantly different from the Original College Normal group on all scales except Hs and Pa. The General College female group was significantly different from the Lough female group on D, Pd, Mf and Sc scales.

Table 3

Percentage Distribution of 542 General College Students on ?, L, and F Scales

T-Score	?	L	F
70+	—	3.	2.7
60–69	.1	15.3	13.2
50–59	99.9	81.7	84.1

A comparison of the Male population showed the Torrens group of junior medical students significantly different from the Original College normals on Hs, D, Pd scales. The College Industrial group was significantly different from the Original college normals on D, Pd, Pa, and Ma. scales. The General College males were significantly different from the Torrens male group on all scales except the Mf and Pa. The G. C. males were significantly different from the College Industrial group on all scales except Pa and Ma.

In a normal distribution of scores having a T-score mean of 50, approximately 2% of the scores might be expected to be at 70 or higher. Because the items selected on the MMPI were largely marked in the unfavorable direction, the distribution is slightly skewed and from three to five percent of the scores of the general population exceed 70.

[2] All differences mentioned as significant are at the 1% level. In computing the significance of the difference between groups, the homogeneity of variances was first checked (1% level) before deciding whether or not to pool them in computing the standard error of the difference.

When the percentage of scores of 70 and over, in the General College population, was compared with the *maximum* percentage expected in the general population, it was found that, in the female group, this 5 per cent figure was equalled on the Pd scale, and exceeded on the Mf scale (6%) and on the Ma scale (9%). The percentage frequency of these deviate scores among the male group exceeded the maximum 5% figure of the general normal population distribution on each scale.[3] The percentages were:

Hs	D	Hy	Pd	Mf	Pa	Pt	Sc	Ma
6.8	11.8	10.8	7.4	9.1	8.5	6.8	6.8	18.8

Applying the chi-square test of significance it was found that the male General College population exceeded the maximum expected frequency at the 5% level of confidence on the D, Hy, Mf, Pa and Ma scales. The female group exceeded this level only on the Ma scale.

Since chi-square is a test of significance and not a measure of the degree or magnitude of the relationship, it is worthwhile to call attention to the fact that, on the scales on which the General College populations were significantly different from the college normal group, the actual percentage frequency occurrence of deviate scores was from two to four times as great as the maximum expected by the authors of the test in the general population.

On the basis of comparisons just made it would seem that, while there is a similarity in the pattern of the profile of the various college groups, there are significant differences not only between the scores of the General College populations and the original college normal population, but also among the several college populations on which MMPI data were available. In addition, the frequency with which deviate scores of 70+ on the MMPI occurred in the General College population was considerably greater on many scales than would be expected by the authors of the test in a normal population. Since these mainly non-pathological populations can hardly be regarded as other than populations which differ significantly in their scores on the MMPI, it would seem that no one of them can be taken as representative of college students in this respect. Thus a valid interpretation of an individual profile on the MMPI would seem to involve a knowledge of whether the group of which the individual is a member differs significantly from the original "college normal" population used in the construction of the MMPI, and *whether or not this difference is of psychological significance.*

[3] The work of Darley, Williams et al. (10) indicated that the General College population with which they were dealing was as well adjusted as any college group. The elevated MMPI profiles of the present General College group do not seem to correspond with this finding. A later article will deal with this.

It would be unwise to attribute psychological significance to differences which are only statistically significant. Without clinical evidence it would appear to be an equally grave error to ascribe psychological significance to scores classed as deviate with reference to the original norm group, which are not deviate scores when referred to the mean of the population with which we are working. In the General College male population, for example, a T-score two standard deviations above the mean of the group on the Ma scale would be 80.67. Clinical evidence alone can decide whether a T-score of 70 or a T-score of 80 on the Ma scale should be taken as "borderline" in this population.

Personality tests are essentially an expression by the subject of his opinion or feeling on certain questions of a personal nature. Meehl and Hathaway (8) feel that college persons in particular tend to be on the defensive, consciously or unconsciously, in answering these questions, and developed the K scale on the MMPI to measure this tendency. They found that college persons tend to be differentiated from others on this scale but felt that the factors of age, intelligence, and the mere fact of being in college could be eliminated as the chief factors in this differentiation. They concluded that socio-economic status is the most plausible remaining variable which might account for the differentiation.

It would appear that the manner in which the items in a personality test are answered is not a function of the test situation, as in so many achievement and intelligence tests, but is rather a function of some other part of the subject's life. Cultural and environmental factors could influence the opinions of individuals on these questions to such an extent that it would be difficult to pronounce any one answer as normal or average for all populations.

Inspection of items selected from the MMPI suggests how, in certain cultures or environments, the answer "true" would be the response of an average individual, while in other cultures "false" would be the prevailing response. Such illustrative items are:

"I go to church almost every week."

"I believe there is a devil and a hell in after life."

"I pray several times a week."

"I read in the Bible several times a week."

"I do not like to see women smoke."

"I believe women ought to have as much sexual freedom as men."

"Children ought to be taught all the main facts of sex."

It would seem that answers reflecting the individual's culture and environment in these, and in other items, might so influence the score on the test that a given score would not have the same significance in different populations.

Some of the characteristics of the General College population which may influence the significance of scores on the MMPI are the cultural and economic status of the homes, their geographic location, the education of the parents, the religious background of the home, and the educational aspirations of the parents for the children. Other factors which may influence the significance of scores are the general ability level of the students, their vocational aspirations, their success in achieving educational and vocational goals, their success in finding a rounded social life in college, and the general morale of the student body.

The General College population may be different from the general population simply because it is a college group. The academic standing of most of its members may make it a population different in many respects from another college group, or from an unselected college population. In any case it is possible that many factors such as those already mentioned have operated in the General College population to an extent sufficient to cause a difference in attitude which might account for scores on the MMPI which are significantly different, not only from the general normal population, but also from the original college normal group, and from other college populations on which data were avilable. In this case it would seem that some modification of the usual interpretation placed on an MMPI profile may be necessary to insure a valid estimate of the personality of individuals in this population.

In the field of intelligence and achievement testing it has become accepted practice to establish local norms for the population in which the test is to be used, as a basis for counseling. In the field of personality testing, however, this procedure does not appear to have been followed to any great extent. Norms are usually established by the authors of a personality test, and these tend to be accepted as valid for all populations.

The differences among the college populations noted here, and the differences between these college populations and the original "college normal" population would seem to be of sufficient magnitude and significance, even though slight, to emphasize the need of caution in the interpretation of the MMPI profile. Meehl (7) has pointed out that scales such as the MMPI acquire whatever non-statistical meaning they possess from the clinical description of those extreme deviates who make up the diagnostic categories for which the various scales are named. Hathaway and McKinley (3) have indicated that, while 70 is a borderline score, useful interpretation of a score always depends upon the clinician's experience with a given group. If, for example, a deviate score of 70+ on the Ma scale of the MMPI can occur in one mainly non-pathological population with a frequency four times as great as in another mainly non-

pathological population, it would seem that, without clinical evidence, this score of 70+ does not have the same significance in the two populations. If a presumably non-pathological population has a mean profile on the MMPI significantly depressed or elevated, with respect to the original group on which present norms are based, clinical experience with the new population would seem to be necessary before a valid interpretation can be made of an individual profile in this population. If the differences noted in this study are the result of cultural and environmental factors, rather than the result of a larger incidence of abnormal amounts of the personality traits being measured, it would seem imperative that personnel workers secure much more information than they now possess about the scores on the MMPI of the population with which they are dealing, if they are to make valid interpretations of an individual profile in this population.

The first step in this direction would seem to be a testing program which will furnish sufficient data to enable the personnel worker to determine whether or not the population with which he is working is significantly different, with respect to the scores on the personality test, from the original population on which the norms for the test were established.

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Television's Effects on Leisure-Time Activities

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Television is rapidly coming over the horizon as a major medium of communication. Though still circumscribed in its coverage, it is apparently due for relatively speedy expansion. Its advent has stimulated a host of guesses as to its coming effects on our lives.[1]

In the belief that television's effects—whatever their eventual nature—deserve serious and continuing study, the psychology department of Hofstra College has set up a Television Research Program to conduct periodic studies of the new medium's social and psychological effects. The Program's studies, originating in April, 1948, when television began to attract its first real attention, will be able to follow the changing patterns of its influence as the new medium grows.

To orient ourselves to the problem and sketch in its broad outlines we began with a series of a hundred "depth interviews" of television families. These qualitative probings suggested that television may have a pronounced impact on set-owning families: television tends to pull the family together as a unit once more, preempts time and attention formerly given to hobbies, radio, movies and other leisure-time activities, and engenders an intensity of feeling which leads some to refer to their sets as "practically a member of the family."

These interesting findings we regarded as provocative hypotheses calling for more precise investigation. To put them to explicit test we designed a second series of interviews employing a matched-group technique to contrast the actual behavior of television with non-television families. The present report presents the findings of these matched-group interviews.

Method

Selecting a specified period of time for study—the first week in May, 1948—we questioned paired television and non-television families as to how many times they had gone to the movies, how much they had read, listened to the radio and participated in other leisure-time activities during the sample week. A comparison of the frequencies with which these two groups of families, television and non-television, engaged in these activities permits a cautious inference as to television's influence on family activity patterns.

[1] The gist of these guesses is aptly summed up in one magazine's estimate that television may "change the American way of life more than anything since the Model T." *Time*, May 28, 1948, p. 72.

The Matched Families. At this stage so little is yet known regarding the sampling characteristics of television owners[2] that it was impossible to set up proper controls for an accurate sampling study. Rather, we attempted to match each television family as accurately as possible for area of residence and socio-economic status with a non-television family.

The interviews were done on Long Island by students in the author's class in Consumer and Opinion Research, who had done several such surveys during the year. To hold constant interviewer bias and error in judging economic status they were done in pairs, one TV and one non-TV, by the same interviewer. For their non-television interviews they selected, on the same block, the house which most closely resembled the TV house in apparent socio-economic status.[3] Since we were not trying to sample specific areas, interviewers tended to work in neighborhoods with which they were personnally familiar, which probably tended to increase the accuracy of their matching of TV and control families.

Table 1

Composition of TV and Control Groups

	Non-TV	TV
Total number of families	137	137
By socio-economic classes:		
"A" group	16	18
"B" group	82	84
"C" group	39	35
Total number of people	498	518
Mean number per family	3.64	3.79

The composition of the two groups is shown in Table 1. Two hundred and seventy-four interviews were obtained, with 137 TV and 137 non-TV families, representing a total of slightly more than a thousand persons. The match is fairly close between the two groups, but the television group leans in the direction of a slightly higher socio-economic status and slightly larger size of family.[4]

Differential Effects on Different Groups? In contemplating the economic impact of television two significant questions come up, having to do with possible differences in TV's effect as it strikes various sub-groups in the population. One has to do with its effects at various economic levels—are they the same in the lower brackets as in the upper? The other concerns the influence of habituation—do these effects diminish as the family gets used to having their TV set around?

The number of our cases is too small to make detailed breakdowns very significant; any findings must be interpreted with extreme caution. Subject to this *caveat*, analyses of our data by economic level were made and the results will be mentioned where they are of interest.

[2] Cf. the disparities in the published figures on the economic levels of set owners. *Television Magazine*, April, 1948.

[3] Sometimes it is the block's most well-to-do home which has TV; in these cases they were allowed to go to adjacent blocks for non-TV interviews. Interviewing the house next door was discouraged, because of the danger of more than ordinary intercourse and mutual influence between such immediate neighbors.

[4] Our TV group turned out to include a high proportion of upper middle class ("B") and no lower class ("D") families, but we do not mean to imply that this necessarily represents the economic distribution of television ownership in the population at large.

The second question, habituation, arises because some have suggested that television's effects may be transitory—that though there may be an initial drop in other activities, after the family has had its TV set a few months the novelty will wear off and family members will go back to their previous habits. To test this "novelty theory" we split our TV group according to length of set ownership. We found that the group halved itself at the six-months point, so we termed owners of less than six months' duration "new owners," and those of six months or more "old owners." Sixty-eight families are "new owners" and 69 are "old owners," 30 of whom have owned sets for a year or more. Thus there are enough instances of long-term ownership to show up any marked effects of habituation.

Results

I. "Out-of-Home" Activities

Our information on leisure-time activities of television and non-television families can be grouped into two categories: "out-of-home" entertainments such as movie going and sports attendance, and "at-home" activities such as reading and radio listening. Among television families the overall level of participation in activities outside the home was only about three-fourths that of non-television families; the specific figure, of course, varies with the activity in question.

Motion Picture Attendance. The coming tug of war between television and the movies has already attracted considerable attention in the entertainment world. Varied opinions have been expressed as to the extent of television's encroachment upon movie attendance. Our own data suggest that it may be moderate.

Fifty-nine per cent of our television families believe they attend movies less often since they got their television set. The figure is the same for both "new owners" (had set less than six months) and "old owners" (six months or more). By economic levels, the percentage is highest (69%) among the middle-class ("C") group. Thirteen per cent of the total group also report that they *enjoy* movies less since having television in their homes.

These answers are in terms of people's recollection of the changes in their habits. What does their actual attendance for the sample week show, when compared with the non-television controls? Table 2 gives these figures.

In the non-television group there were 61.6 attendances per hundred persons (one "attendance" = one person one time). In the television group there were 49.2 attendances per hundred—twenty per cent fewer than in the control group.

At all socio-economic levels the rate of attendance was lower among the television families than among the corresponding control families, though on the "A" level the difference is not statistically significant, due

Table 2

Participation in "Out-of-Home" Activities

Type of Activity:	Non-TV Families	TV Families	Per Cent Decline in TV Group
	Attendances per Hundred Persons		
Motion pictures	61.6	49.2	20%
All others	63.0	45.0	29%
(Other commercial)	(54.4)	(38.3)	(30%)
Total "out-of-home"	124.6	94.2	24%

to the small number of cases here. The difference was greatest (33%) in the middle-class ("C") group.

The difference in movie attendance by adults (28%) is more marked than the difference in children's attendance, which is so slight (7%) as to be statistically unreliable. There is no reliable difference in rate of attendance between "new" and "old" owners.

Other Forms of Entertainment. Movie-going was the most frequent single activity, with sufficiently high attendance rates to yield relatively reliable figures. The figures on other entertainments are reliable only when several activities are grouped together; we cannot single out specific forms for comparison.

Grouping together all other out-of-home entertainments except movies, we find the participation of television families to be 29% lower than that of control families (Table 2). It is lower on all economic levels, but again the difference is not significant on the "A" level. The decline is relatively similar for adults and children. Old owners' level of participation is slightly but not significantly lower than that of new owners.

Commercial types of entertainment (involving paid admission) seem to suffer slightly more than non-commercial types (parties, socials, etc.). The greatest decline appears to be in such activities as dining, dancing, night-clubbing. The smallest difference between TV and control families was in their attendance at sports events (baseball, the fights, the races) but the figures here are too scanty to be reliable.

Combining movies and other form of entertainment we find that the total participation in out-of-home activities is about 24% less for television than for non-television families. The decline seems to be greatest on the middle-class ("C") level and it is as evident for old owners as it is for new owners.

II. "At-Home" Activities

Not only entertainments outside the home but also leisure-time activities carried on at home suffer under the influence of television. Perhaps the two most important of these are radio listening and reading, competing with television as media of communication and advertising.

Radio Listening. The television group averages slightly more radio sets per home than the control group (medians are 3.9 and 3.4, respectively) suggesting that before television they may have been even more active radio listeners. We have already seen that they spend less time out of the home, so that apart from television itself they seem to have equality of opportunity for listening to the radio, in point of time and sets available.

Table 3

"At-Home" Activities

Activity:	Non-TV Families	TV Families	Per Cent Decline in TV Group
Hours of radio listening:			
Day (before 6 p.m.)	3.5	2.6	26%
Night (after 6 p.m.)	3.4	1.1	68%
Percent of family listening:			
Daytime	39%	38%	—
Nighttime	74%	51%	31%
Amount of reading:			
Hours per family	21.3	17.5	18%

As Table 3 shows, however, television owners use their radios 26% less during the day and 68% less at night than do non-television families. The greater decline in nighttime listening, of course, reflects the fact that the bulk of television broadcasting is still in the evening hours.

The greatest difference between television and control families appears on the middle-class level, where non-television homes average nearly four hours per night as against one-half hour for television homes. There are no significant differences between new and old owners.

The drop is not only in the amount of listening but also in the number of people customarily listening when the radio *is* on. During the daytime there is virtually no difference, but at night three-fourths of the members of non-television families usually listen to the radio, where only half the members of television families listen.

Reading. Reports on the number of hours spent in reading during the preceding week are perhaps less reliable than reports on other activities, due to greater difficulties in memory and greater temptation to falsify for

reasons of social prestige. These cautions should be remembered in noting our figures.

The effect of television upon reading habits will be especially interesting to follow in its development, for both are essentially visual media and both (unlike radio) require relatively undivided attention. Thus in a sense these two might be thought of as being in more direct competition than even television and radio.

From a number of comments made in the preceding depth interviews, we had gained the impression that reading might suffer considerably in homes with television. Our present data do not support that impression. Compared to radio listening and many other entertainments reading is holding its own relatively well in our TV families. Table 3 shows an overall decline of only 18% for hours spent in reading during the sample week.

There are no consistent trends in reading changes according to economic levels. In both TV and control groups, middle-bracket people did less reading than upper class families, but at all levels TV families read less than the corresponding controls.

Television did not bring any change in *type* of reading between the two groups. For both, most of the reading time is given to newspapers and least to books. By economic levels, the "A" families read more books and the "C" families more newspapers, as would be expected. This was true in both TV and control groups. There was little difference between new and old television owners in either amount or type of reading. New owners did slightly more (18 hours per family) and old owners slightly less reading (17 hours).

III. Attitudes Toward Television

Television owners make relatively extensive use of their sets. Their attitudes toward television in general are enthusiastic and they are favorably inclined even toward the advertising which appears on this medium, finding it preferable to radio's commercials.

Amount of Television Viewing. In relation to the still limited number of hours of television broadcasting available during the week, television families use this medium extensively.[5] They reported an average of 24.4 hours of viewing during the week. Set usage was slightly higher in the upper economic brackets, and averaged 2.5 hours more for new than for old owners.

During these hours that the TV sets are in use relatively large numbers of people are watching them. There was an average of 3.56 viewers per TV set, as compared with 1.9 night-time radio listeners in these same

[5] During the week of this survey, stations in the area were averaging about 25 to 30 hours of broadcasting per week.

families. When family size is held constant, there are proportionately more viewers per set on the middle-class level than on the upper levels.

Opinions of Television in General. By and large television owners are enthusiastic about the medium and are happy to talk about it. Rapport was unusually easy to establish with these respondents and they were remarkably interested in our survey.

We offered them a simple five-point rating scale, with adjectives ranging from "wonderful" to "disappointing," to express their opinion of television in general. The results, in terms of the percentage of respondents selecting each category, are as follows: "Wonderful"—55%; "Good"—37%; "Fair"—6%; "Poor"—1%; and "Disappointing"—1%.

Better than half of them described television as "wonderful"; less than ten per cent rated it anything less than "good." The distribution of answers for old owners is very similar to that for new owners.

Asked for a fuller description of their attitude, owners gave a variety of comments. Perhaps the most common one involved the thought that television is "the closest thing to actually attending the broadcasted event," that "without leaving your living room the world is practically before your eyes." Many tempered their endorsement with the observation that there is "still plenty of room for improvement"; they seem to have faith that this will come with time.

Comparison of Radio and Television Commercials. These predominantly favorable attitudes seem to carry over also to the advertising which appears on television. In the depth interviews many spontaneous favorable comments were made about TV commercials. Some of the comments led to our including a query as to which the respondents liked better, the advertisements on television or those on radio.

This is a question on which owners' opinions are rather definite; only 3% said "neither" or "don't know." Six per cent preferred radio and 91% preferred television commercials. Preference for TV commercials increases as we go down the socio-economic scale, but is less pronounced among old owners than new owners.

Reasons frequently mentioned for preferring TV commercials were that they are "more vivid," "more bearable" and that "not so much is left up to your imagination." Some who preferred radio gave it a backhanded compliment: "radio ads are easier to ignore," "it takes no effort not to listen."

"Psychological Duration" of TV vs. Radio Commercials. Taking advantage of the functional relation between interest and estimation of temporal duration, early radio research used the device of asking how long advertisements lasted as an indirect index of listeners' interest in the commercials. We adapted the same device to provide a comparative index of interest in television versus radio commercials.

For radio and television separately, we asked our TV respondents how many minutes out of every quarter hour they thought were spent on advertising. Comparing the two estimates, we find that 74% of the respondents felt that the number of minutes per quarter hour on advertising was greater for radio than for television; 10% thought the number was greater for television and 16% thought they were equal (Table 4).

It is interesting to note that as we go down the socio-economic scale there is a steady increase in the percentage of answers favorable to television. On the "A" level 61% and on the "C" level 83% feel that radio advertising is more time-consuming. Perhaps this is in part a residue of the differences in the radio programs the different classes customarily listen to and in part a reflection of the generally greater regard in which the lower groups seem to hold television.

Estimates by new owners are more favorable to TV than those of old owners. This is consistent with our previous findings on commercials. In reactions to advertising we have an area where the "novelty effect" does seem to be in evidence.

Though broadcasters' current time limits on advertising are roughly similar for the two media, our results may reflect some actual difference in the duration of radio and TV commercials. But certainly they picture, too, the shorter "psychological duration" of television commercials, and hence reflect their greater interest to the audience. In its effect on people's attitudes, the amount of time *actually* spent on advertising is less vital than the amount people *feel* is given to it.

Table 4

Apparent Duration of TV and Radio Commercials

	Radio	Television
Spends more minutes on advertising:	74%	10%
Mean estimated minutes per quarter hour on advertising:	3.98	2.41

What are their impressions in actual number of minutes per quarter hour? Table 4 shows that they believe radio spends four minutes and TV two and one-half minutes out of every fifteen on advertising.[6] This means that radio commercials seem to occupy 65% more time than do TV commercials—a strong hint of the audience's greater interest in television's presentations.

[6] We checked this estimate for radio against the control group's answers to the same question. The respective means of 3.98 and 4.09 minutes for radio are very similar and indicate that there is no constant bias affecting the TV group's estimates of time intervals in general.

Again we find that the difference between the two media is felt more acutely as we move down the socio-economic scale. Owners in the upper bracket judge that radio spends 50% more time on advertising while middle-class owners feel it spends 88% more time. New owners, too, are considerably more impressed with TV's relative brevity than are old owners.

Summary and Conclusions

1. The results of the present study suggest that television may bring about appreciable changes in the family's pattern of leisure-time activities. Comparing the activities of matched groups of 137 television-owning families and 137 non-owning families during a sample week in May, 1948, we found that television families showed a considerably lower level of participation in most other types of activity.

2. Television families engage in fewer activities outside the home than do comparable control families; their general level of participation was about three-fourths of that shown by the controls. Inside the home there is also a shift in the proportion of time devoted to other activities, with night-time radio listening declining most and reading least among the television families.

3. Television owners are enthusiastic about this medium. They use their sets extensively and have a high opinion of television in general. Even the advertising is much preferred to the commercials on radio.

4. The fact that these attitudes and these differences in habit patterns are for the most part about as evident among owners of many months' standing as they are among those whose sets are still a novelty suggests that television's influence may not be a transitory phenomenon, passing when owners become habituated to their sets.

5. Analysis of our data by socio-economic status suggested that there may be a tendency for television's influence to be felt more strongly, perhaps, among the middle-class families of our group than among those higher in the socio-economic scale. However, the number of our cases is too small for us to draw any more than tentative hypotheses from the results of breakdowns by either length of ownership or economic status.

6. Television as a medium of communication, entertainment and advertising appears to exert an appreciable influence in the lives of set-owning families. On a nationwide scale this influence is probably negligible as yet, but our evidence suggests that as the medium becomes accessible to increasing numbers in the population it may bring with it noticeleab effects on the family's activities in and out of the home.

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Identification of Cola Beverages: II. A Further Study

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In an earlier study,[1] the present investigators gave four different Cola beverages (Coca Cola, Pepsi Cola, RC Cola and Vess Cola) to 108 *Ss* to identify. Results showed an almost total absence of Vess Cola identifications. Instead of responding with the fourth brand name, *Ss* tended to repeat the name of one of the other three beverages listed. These results were interpreted as indicating lack of a gustatory basis for the *Ss'* identifications. It was suggested that these responses were a function of a ready labelling of the series of Cola beverages with a stock of naming reactions that seemed to be related to thoroughness of advertising and other forms of culturalization.

Further confirmation of the correctness of such an explanation came from the results of administering four samples of the same Cola beverage respectively to each of four groups of 15 *Ss*. The picture was not essentially different from that obtained with the 108 *Ss*. As a result, the hypothesis was developed that if only three beverages were used, the identifications would be distributed in an order approximating chance. The present experiment was designed as a test of the above hypothesis.

Procedure

The subjects of the present study consisted of two groups—96 *Ss* in Part I and 60 in Part II. These were beginning students in Elementary Psychology courses.

Part I. Each of 96 *Ss* was admitted individually into the experimental room and was invited to sit down. The following instructions were then read to him.

"We would like to have you taste and identify some Cola drinks. You will be told in what order and when you are to drink them. After you have finished each sample, report your identification to E and take enough water from the paper cup before you to rinse your mouth well."

A tray containing three one-oz. glasses of Coca Cola, Pepsi Cola and RC Cola respectively was placed before the *S*. He was then told to drink the beverages labelled x, y, and z in the order indicated to him.

[1] Pronko, N. H., and Bowles, J. W., Jr. Identification of Cola beverages: I. First study. *J. appl. Psychol.*, 1948, 30, 304–312.

Samplings were spaced about a minute apart, *S's* name and other information being recorded in the interval between drinks.

The order of presentation of the three beverages, determined preexperimentally, was such that each of the three stimuli appeared in the first, second and third position 32 times. This counterbalanced order was used to preclude the operation of position effects or stimuli interactions orally. All beverages were kept out of sight of *Ss* and were placed in a refrigerant maintained at approximately 5°C.

Part II. In Part II, 60 *Ss* were administered the *same* Cola drink at each of three trials. Thus, 20 got all Coca Cola; 20, all Pepsi Cola; and 20, RC Cola. In all other respects, the procedure was the same as that of Part I.

Results and Discussion

Inspection of Table 1 shows that, as in the previous study which utilized four different Colas, the three most common identifications are apparently related to the three most frequently advertised Colas with a sprinkling of such unexpected beverages as Root Beer, Dr. Pepper, Nehi, and Red Rock.

Table 1

Showing the Distribution of 288 Identification Responses When Each of the 96 *Ss* Was Presented in Turn, but in Counterbalanced Order, with a 1 oz. Sample of Coca Cola, Pepsi Cola, and RC Cola

Brand Given *S*	Frequency of *Ss'* Various Identification Responses										
	C.C.	Pep.	R.C.	Dr.Pep.	Cleo	Fount. Coke	Root Beer	Red Rock	Nehi	D.K.	Totals
Coca Cola	39	26	22				1	1	1	6	96
Pepsi Cola	35	36	20		1					4	96
RC Cola	15	34	34	2	4	2		1		4	96
Totals	89	96	76	2	5	2	1	2	1	14	288

Coca Cola is properly identified 39 times but is misidentified as Pepsi Cola 26 times and as RC Cola 22 times while Pepsi Cola is correctly identified 36 times but is also misidentified as Coca Cola 35 times and as RC 20 times. RC Cola is correctly named 34 times but is misidentified as Pepsi Cola exactly as often and as Coca Cola 15 times. Perhaps the low frequency of misidentifications as Coca Cola is due to the higher frequency of misidentification with other beverages.

From Table 2 of Part II (where each of 20 *Ss* was given three samples of the *same* Cola) it will be noted that results are not much different. Coca Cola is identified as Coca Cola 27 times but is misidentified as Pepsi Cola 20 times and as RC nine times. However, when Pepsi Cola

Table 2

Showing the Distribution of 180 Identification Responses When Each of the 60 *Ss* Was Presented with Three 1 oz. Glasses of Either Coca Cola, Pepsi Cola, or RC Cola

Brand Given *S*	Frequency of *Ss*' Various Identification Responses							
	C.C.	Pep.	R.C.	7 Up	Dr.Pep.	Vess	D.K.	Totals
Coca Cola	27	20	9	1	1		2	60
Pepsi Cola	22	19	17		2			60
RC Cola	27	15	17			1		60
Totals	76	54	43	1	3	1	2	180

is given three times in succession, it is said to be Pepsi Cola 19 times, Coca Cola 22 times and RC 17 times. As regards RC Cola, it is correctly identified as RC only 17 times but wrongly identified as Pepsi Cola 15 times and as Coca Cola 27 times! In every instance, regardless of the stimulus used, Coca Cola is the response of greatest frequency. It is conjectured that these results may reflect the relative effectiveness or extent of the advertising employed by the three main Cola competitors.

Table 3 shows the percentage of correct responses when *Ss* were given three *different* Colas. Note that for Coca Cola this percentage is 41 as compared with 38% for Pepsi Cola and 35% for RC Cola. It is suggested that the slight differences among the three categories of correct identifications is a function of a relatively greater frequency of certain naming responses. Apparently this interpretation is valid because an examination of Table 4, which shows classification of identification responses when the three samples consisted of the same Cola for each *S*, indicates a similar trend. Although Coca Cola is given to the *Ss* each of three times, it is correctly identified 45% of the time but is misidentified 55% of the time, this, despite the fact that Coca Cola naming responses constituted 76 of the total 180 responses. Although the Cocal Cola response is given over and over, nevertheless it does not yield a high

Table 3

Identification of Cola Beverages by 96 *Ss* When Each *S* Was Presented a Sample of Each of Three Brands

Identification	Brands of Cola Presented							
	Coca Cola		Pepsi Cola		RC Cola		Totals	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Correct	39	41	36	38	34	35	109	38
Incorrect	57	59	60	62	62	65	179	62
Totals	96	100	96	100	96	100	288	100

batting average. As regards Pepsi Cola, it is correctly identified only 32% of the time and is misidentified over twice as often (68%)!

Results for RC Cola are even more striking. This beverage is misidentified 72% of the time. The low percentage of correct identification (28%) is, perhaps, a function of the greater frequency of occurrence of the Coca Cola response. *Ss* could not get in as many RC Cola namings

Table 4

Identification of Cola Beverages by 60 *Ss* When Each *S* Was Presented Three Samples of the Same Brand

Identification	Brands of Cola Presebted							
	Coca Cola		Pepsi Cola		RC Cola		Totals	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Correct	27	45	19	32	17	28	63	35
Incorrect	33	55	41	68	43	72	117	65
Totals	60	100	60	100	60	100	180	100

because they had exhausted this opportunity by giving the "Coke" response too often. The overall picture shown in Table 4 is also important. The total number of correct identifications, 63 out of 180, gives a value of 35%, which means that 65% of the responses were misidentifications. These results are in line with the expected 33⅓% of correct namings, which might occur "by chance."

In the previous study, when four different Cola beverages were employed, results suggested that the pattern of naming responses was a

Table 5

Critical Ratio Tests of the Hypothesis That the Distribution of the Various Identification Responses to the Three Cola Beverages Are Not on the Basis of Actual Taste Stimuli

Beverage Used	How Identified								
	As Coca Cola			As Pepsi Cola			As RC Cola		
	Diff	σ_{diff}	Critcal Ratio	Diff	σ_{diff}	Critical Ratio	Diff	σ_{diff}	Critical Ratio
Coca Cola	.105	.071	1.478	.062	.064	.968	.043	.073	.589
Pepsi Cola	.060	.070	.942	.042	.067	.626	.070	.072	.972
RC Cola	.164	.130	1.184	.021	.067	.313	.114	.077	1.480

function of the *Ss'* familiarity with Cola brand names. If that hypothesis is correct, then in this study with use of three brands of Cola, we should expect on a statistical basis to get a chance distribution of Cola names *regardless* of beverage employed. Actually, Table 5 proves our

hypothesis. The correct identifications of the three respective Colas do not differ significantly from chance expectancy since it will be observed that no critical ratio approaches 2.0 and only three are above 1.0. In other words, in applying names to identify the three Colas our *Ss* might

Table 6

Critical Ratio Tests of the Hypothesis That the Distribution of the Various Identification Responses to the Three Cola Beverages Are Not on the Basis of Actual Taste Stimuli

	How Identified								
	As Coca Cola			As Pepsi Cola			As RC Cola		
Beverage Used	Diff	σ_{diff}	Critical Ratio	Diff	σ_{diff}	Critical Ratio	Diff	σ_{diff}	Critical Ratio
Coca Cola	.022	.076	.280	.037	.059	.627	.124	.092	1.340
Pepsi Cola	.044	.077	.571	.019	.089	.213	.062	.101	.613
RC Cola	.022	.076	.280	.055	.086	.639	.062	.101	.613

just as well have drawn such names from a hat. Comparison of Table 5 with Table 6, which latter shows results of Part II where each of the three stimuli given *Ss* were the same, indicates similar results. Critical ratios for percentage of correct responses again do not show a difference from chance expectancy. With one exception (a *CR* of 1.3), all *CRs* are below .70.

Table 7

Critical Ratio Tests to Determine Whether Differences Between Percentages in Results of Part I and Part II Are Significant

	Brands of Cola Presented			
Statistic	Coca Cola	Pepsi Cola	RC Cola	Totals
P_1 (% correctly identified in Part I)	41%	38%	35%	38%
P_2 (% correctly identified in Part II)	45%	32%	28%	35%
P_1–P_2	4%	6%	7%	3%
σ_{diff}	.081	.078	.076	.046
Critical Ratios	.494	.769	.921	.652

As a final test of our hypothesis, we present the data of Table 7. Here are compared the correct responses in Part I (three different Cola samples) and Part II (three samples of the same Cola). The differences in correct naming responses are not statistically significant as evidenced by the extremely low significance ratios. For the Coca Cola, Pepsi Cola

and RC Cola categories the *CRs* are respectively .49, .77 and .92, indicating that the pattern of naming is essentially the same regardless of presentation of (a) three different samples of Cola or (b) three samples of the same beverage.

Summary and Conclusions

A group of 156 *Ss* was asked to identify one-oz. samples of the following three Cola beverages: Coca Cola, Pepsi Cola and Royal Crown (RC) Cola. In Part I, 96 *Ss* were presented one of each of three different Colas and in Part II, 60 *Ss* were given three samples of the *same* beverage, being evenly divided among the three different classes.

In general, results show that whether *Ss* are given three different beverages or the same beverage three different times, the identifications are not essentially different in the two cases. All critical ratios are extremely low and lack statistical significance. Within the limits of the present experiment, the findings permit the generalization that when subjects are asked to discriminate and identify Cola drinks, they might do just as well by drawing the names of those beverages out of a hat.

Received February 6, 1948.

Book Reviews

Tiffin, Joseph. *Industrial psychology.* New York: Prentice-Hall, Inc. Second edition, 1947. PP. xxi and 553. $5.35.

This book is a revision of Dr. Tiffin's earlier edition. Two new chapters have been added, one on interviewing and related employment methods and one on wages and job evaluation. The other chapters have been revised to include some recent studies. The general organization and method of presentation are unchanged.

Chapter One deals with individual differences and is followed by the new chapter on employment methods. This chapter covers the topics of interviewing, job analysis and specifications, statistical analysis of personnel data, statistical and clinical use of application blanks, and similar phases of the employment procedure.

The next five chapters deal with the general principles and specific applications of employment tests. The discussions of the tests are brief and cover a representative sample of tests. These chapters are well done and cover the area adequately. There is a good emphasis on tests for placing as well as selecting new employees. Validity data in terms of costs—a very desirable criterion that is not often used—are presented. The concept of the selection ratio is discussed in a very readable manner. Chapter Nine is a case study of psychological contributions in testing and training brought to bear upon a specific job, and it synthesizes these procedures excellently. The usual topics of rating scales, safety, training, efficiency and morale are considered in the other chapters that comprise the book.

Although the entire presentation is very readable and generally satisfactory, there are quite a few questionable details scattered throughout that weaken the book. For example, some correlation coefficients are given unusual interpretations. One r of $-.07$ is said to be significant while others ranging as high as .35 are held insignificant (pp. 305, 306, 307, 420.)

In other places the statistical significance of results is questionable, but there is no discussion of tests of significance. It would probably have been desirable to include this concept, particularly since statistical techniques as advanced as factor analysis are discussed. To give one example, data are given comparing successful and unsuccessful laundry "pressers" but the overlapping of the groups, the critical ratios of the obtained differences, and even the numbers of cases are not mentioned (p. 34).

The method of drawing graphs is another detail in which a different manner of presentation would have been more satisfying, at least to this reviewer. In many instances inter-relationships are shown by drawing trend lines that connect the midpoints of class intervals. Scattergrams would have been more meaningful. This may be shown by reference to one graph showing the relation of job performance to test scores for a group of "quillers" (p. 141). With successively higher minimum acceptable test scores, the average production index is also higher. To get successively higher minimum acceptable test scores, it is apparently necessary to drop off some cases from the low end of the distribution of test scores. Thus, each succeeding class interval has fewer cases than the next lower class interval. There are only 28 quillers involved in this study. Each class interval above the first one must accordingly have some number of cases less than 28, but it is not possible to determine how many since more complete data are not given. This may mean that the high end of the trend line is based on so few cases as to be nearly spurious, although the graph as presented apparently shows a very high relationship of test scores to production. It is unfortunate that more information, such as in the nature of a scattergram, is not given.

Other graphs show other kinds of weaknesses, some of which may be mentioned. One bar graph has no scale (p. 255). A learning curve is labeled "slow gains" at the place where it is most accelerated (p. 252). A graph shows the effect of occupational eyewear in one situation (p. 233). Six employees provided with glasses eventually produced more than did a "control group" without glasses. But the six had a more rapidly accelerating output curve than did the controls, even before the glasses were introduced. Thus, the value of the controls used in this study is questionable. The six are said to have reached a higher peak of production than did the controls, but this latter phenomenon is not shown in the figure. Many other graphs violate the rules laid down by a Committee of the American Statistical Association by failing to begin the vertical and horizontal scales with zero. The effect is to exaggerate relationships for the unwary.

In two places the book may be criticized on a broader basis. In the discussion of merit ratings, and again in the discussion of job evaluation, the technique of factor analysis was applied. In each instance the end result was an abbreviated scale. It is highly questionable if these recommended scales are as desirable as might at first appear.

Based largely upon a factor analysis a merit rating system was developed that consisted of two factors or items, job performance and supervisory potential. It is questionable if this two item rating represents any advance over non-analytical techniques wherein a supervisor ranks his

employees on their effectiveness, and ranks them in order of promotability.

The inclusion of a rating for supervisory potentiality violates one of the widely accepted principles of merit rating. That is, Tiffin advocates rating *potential* as well as *actual* behavior, with no justification for this step. Nor does he question the ability of supervisors to rate the potentialities of their subordinates.

In similar manner, a factor analysis of some job evaluation systems leads to the recommendation of a system involving only two or three factors (p. 390). The analytical values of evaluating jobs are lost if only two or three factors are to be considered. The primary purpose of a job evaluation program in any concern is to maintain harmonious working conditions or morale. It is not to establish a scientifically "true" basis for paying wages. Rather, it is to establish an equitable and practical system and to have the employees realize that they are being paid according to an equitable and objective system. Tiffin apparently recognizes this, as shown by some of his discussions, but he sacrifices the human relations aspect of job evaluation when he advocates a system that is statistically sound but psychologically unsatisfying. Tiffin undoubtedly performs a service in showing that job evaluation systems need not be based on twenty or thirty factors, but he appears to have leaned over a little too far in recommending a very small number of factors. Perhaps about five factors are best, considering the psychology of the situation.

In summary, this book is valuable as a text for a beginning course in industrial psychology. But it should be supplemented by other sources and it will be most effective when analyzed carefully by the instructor.

Harold F. Rothe

Stevenson, Jordan & Harrison, Inc.,
Chicago, Illinois

Brodman, K. *Men at work.* Chicago: Cloud, 1947. Pp. 191. $2.50.

In surprisingly few pages Dr. Brodman has presented an extremely readable book about the "Supervisor and His People." This book, based on experiences in the Cornell Caterpillar Tractor Company personnel program, is directed at front line supervisors in the hope that they will be aided toward a better understanding of their workers and themselves. The author presents his message largely in dialogue form featuring a paragon of supervisors as he deals with various "types" of workers, such as "complainers," "shirkers," "slow learners." Joe, the supervisor-narrator, is indeed a composite of many desirable supervisory characteristics and virtues. Although this book will find its way into the libraries of few professional psychologists, it should be required reading in any supervisory training program.

The advantages of this volume can be simply stated: (1) it is easy to read and to understand (because of the careful choice of words and the use of the popular idiom, the dialogue presentation, and the summary and suggestions after each "problem"); (2) it contains tested psychological principles and methods for employee counseling (such as being a good listener, the limited use of advice, aiding catharsis, utilizing experts, environmental manipulation); (3) it answers a definite need for a supervisor's handbook in human relations.

There are, however, certain objections to the book which this reviewer feels should be mentioned. First, there is a definite suggestion of paternalism in the sub-title, "The Supervisor and *His* People" (italics mine), as well as in Joe's somewhat irritating omniscience. Second, the reader who is a supervisor may get the false impression that simply by following Joe's example he can be successful in keeping his department happy and efficient. Only to a certain degree is this true. Actually, a greater amount of space could have been devoted to a realistic appraisal of what percentage of "successes" a supervisor might reasonably expect.

These reservations, however, do not detract seriously from the merits of *Men at work*. Dr. Brodman has done a commendable service for the advancement of human relations in industry by writing a book for front line management, the supervisors.

William A. McClelland

Brown University

Shartle, Carroll L., (with the assistance of Sanford Cohen). *Vocational counseling and placement in the community in relation to labor mobility, tenure, and other factors.* New York: Social Science Research Council, 1948. Pamphlet 5.

This memorandum prepared for the Committee on Labor Market Research of SSRC is concerned with "the effectiveness of vocational counseling and placement in the community and particularly with the role of employment services and their impact on the distribution of labor." Its purpose is to explore the directions in which research might be planned.

This is an important publication because it directs attention to the need for evaluating the effectiveness of vocational counseling and placement as a phase of research on labor market processes and behavior. It is an important statement for psychologists because it points to an area of research involving a joint relationship between applied psychology and applied economics and sociology which has been largely overlooked.

In general, this reviewer found the specific questions, considered apart from their topics, to be significant and suggestive of important

inquiries. In propounding the topics, however, the writers are considerably less articulate. A confusing factor is the failure to differentiate between vocational counseling and placement and to allocate to each its proper role in the entire vocational adjustment process.

A second lack of clarity stems from the major emphasis upon the role of the public employment service. The treatment in this memorandum might better have been limited to those issues which are common to all programs of counseling and placement regardless of their sponsorship. This is particularly relevant when it is observed that the most extensive program of vocational counseling now in existence is under the auspices of the Veterans Administration and that this is accompanied by what amounts to a program of placement relatively independent of the public employment service. Also, the role of public education looms large both at the present time and in the future in the provision of counseling services and, to a lesser, extent, placement. It may be anticipated that an increasing amount of adult vocational counseling will be under the auspices of adult education programs.

The usefulness, in terms of stimulation of research, of this memorandum would have been greatly enhanced if the authors had keyed in the bibliography to the questions so that the prospective researcher would have a more adequate guide to the work that has been done on specific issues. Such an arrangement also might have brought to the attention of the authors the fact that their bibliography, although admittedly "selected," omits what are perhaps the most significant researches and accounts of operating programs in this general area. A major omission is the volume *Men, women, and jobs* which summarized the extensive research on individual diagnosis and training done by the Minnesota Employment Stabilization Research Institute in the early thirties. Although this research program set the stage for the later work of the Occupational Research Program of the U. S. Employment Service, it is not referred to; yet the researcher who fails to start his survey of the literature with this account and with study of the monographs on which it was based, will miss the classic in one important phase of this field. Reference is lacking also to the highly significant studies of the E. S. R. I. just prior to World War II when such titles as "Employment Prospects of Men and Women Registrants in the United States Employment Service in St. Paul," "Mental Competence of Men and Women Registrants in the United States Employment Service in St. Paul," "Dominant Causes of Unemployment, Duration of Unemployment, and Relief Status of Unemployed Registrants in the United States Employment Service in St. Paul," and similar ones were issued. To the reviewer's knowledge, the only quantitative evaluations of employment agencies made to date

are the two by Paterson and Kriedt reported in the *Personnel Journal* and in *Occupations* in 1947 but which are unmentioned in the present publication. Certainly the counseling manuals put out by both the U. S. Employment Service and the Veterans Administration also should be brought to the attention of the reader qualified in the field of economics but lacking background in the field of counseling. The U. S. E. S. study in St. Louis on counseling in the Employment Service also deserves mention. Others can be recalled.

Undoubtedly this memorandum will serve to initiate students of labor market problems into the issues involved in evaluating programs of counseling and placement.

Arthur H. Brayfield

University of California,
Berkeley, California

Reports Submitted to the Civil Service Assembly by the Committee on Placement in the Public Service and the Committee on Probation in the Public Service. *Placement and probation in the public service.* Chicago: Civil Service Assembly, 1946. Pp. v–xvi; 201.

The foreword to *Placement and probation in the public service,* by James Mitchell, Director of the Civil Service Assembly, closes with these words: "It should be made clear that these reports were not prepared with a view toward their official approval or formal adoption by the Civil Service Assembly, its Executive Council, or its Headquarters staff, and no action of this nature is contemplated. Indeed, such action is hardly required, for these forward-looking reports are the fruits of the joint efforts of competent chairmen and their able associates. As such, they can afford to stand on their own authority in commanding the reader's attention."

Even though psychology, as compared to public administration, has long been known facetiously as the science of verifying the obvious, Mr. Mitchell's foreword, plus the absence of content in the book under review, should hasten the day when public administration will earn an equally descriptive aphorism: The art that obscures the obvious.

The foreword, as quoted, is a disclaimer of responsibility under the guise of policy. The text is almost completely wanting in substance.

When the editor of THE JOURNAL OF APPLIED PSYCHOLOGY transmitted the volume, he suggested that a review might be worth 500 words; he did not mention, however, that the book is now two years old and is most attractively bound.

Contributors to Parts I and II, placement and probation in the public service, are well known. Many of them are personal friends of the reviewer. But this fact does not deter him at this juncture from express-

ing a blunt opinion. Nor does it keep him from offering his friends and colleagues such sanctuary from their reluctant contributions as may be found in a paraphrase of Marcus Antonius: "So are you all, all honorable men."

Placement and probation in the public service, as elsewhere, are still two unscaled peaks. And the present text adds little to the hope for an ascent. It does not recite the experiences of the able climbers who have attempted the heights; it is not a view by voyagers who, far inland, have sighted the sea. Rather, it is a glimpse downward of conventional apologists outdoing convention apologetically. It is a product of the committee method, and a warning to those who live, and hope, and have their being in that method.

Fred S. Beers

Federal Security Agency

Leeper, Robert. *Psychology of personality.* Ann Arbor: Edwards Brothers, 1946. Pp. 167. $2.00.

Were I teaching elementary general psychology, this little book would be my text for the first unit. It is interestingly written about things of vital concern to students, yet it does not evade difficult concepts nor seriously oversimplify them. The author's general theory of personality is not obtruded or defended before the court of his professional peers—as a matter of fact it seems to be a rather eclectic theory of no great novelty—but the treatment has that systematic form which proceeds only from a basic theory. Inferior students will get from this book more than the usual number of *ad hoc* generalizations which they can use; and superior students will, I believe, deepen their understanding of human behavior.

Horace B. English

The Ohio State University

Missiuro, Włodzimierz. *Znużenie O fizjologicznych podstawach racjonalizacji pracy.* (Fatigue: Physiological bases for scientific management.) Warsaw: Książka, 1946. Pp. 255.

The author is a professor of applied physiology at Warsaw University but he wrote the book in Scotland during the latter part of World War II, a fact reflected in a large number of references to British investigations. The author acknowledged his intellectual debt also to the Harvard Fatigue Laboratory (now defunct). The third important source of material for the book was the experimental studies carried out by the author and his collaborators, grouped around the journal *Przegląd Fizjologji Ruchu* (*Review of Physiology of Activity*) published up to 1939 in Warsaw.

Three types of fatigue are distinguished: fatigue produced by physical activity, associated with mental effort, and related to emotional strain. The author focussed his attention on fatigue resulting from muscular work. Large space was devoted to biophysical and biochemical phenomena of fatigue observed in isolated muscle. The changes in functional characteristics of the intact organism, taking place in the course of strenuous physical work, were considered in a broad frame of reference; it was pointed out that muscular activity is dependent on the nervous, circulatory, respiratory, alimentary, and other functional systems. Furthermore, fatigue of the industrial worker was regarded as being related not only to the work itself, its duration and intensity, and the physical environment but also to the social and economic factors.

In occupational fatigue there is frequently a distinct lack of changes measurable in terms of classical physiological and biochemical variables. In addition to the fatigue of the effect or system (muscle as contractile structure) and of the cardio-respiratory and biochemical changes, attention was paid to the fatigue of the apparatus of excitation and conduction; the study of the fatigue of the central nervous system is one of the central tasks of industrial physiology.

In terms of the intensity of its manifestations and the speed of recovery, fatigue was classified as subacute, acute, and chronic. In acute fatigue there is a reduction of the capacity to continue the activity or, if the same level of performance is maintained, it can be done only at the cost of an increased effort. Chronic fatigue is regarded as a pathological condition, reflected in diminished vitality and resistance to disease.

The book is concerned primarily with fundamental questions of fatigue. The applied problems such as the optimal intensity of work, length of the work day, placement and duration of rest-pauses are considered only briefly. The text is somewhat uneven in difficulty. In the contemplated English edition the presentation of all elementary information should be eliminated, pitching the monograph at a moderately advanced level of physiological and biochemical training. As it is practically impossible to discuss thoroughly in the same book both the theoretical background and the problems of industrial fatigue, concentration on the former would appear advisable. This would allow an increase in the amount of documentary material. With these modifications an English edition would represent a welcome contribution to the science of human work.

Josef Brozek

Laboratory of Physiological Hygiene
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New Books, Monographs, and Pamphlets

Books, monographs, and pamphlets for listing and possible review should be sent to Donald G. Paterson, Editor, Department of Psychology, University of Minnesota, Minneapolis 14, Minnesota

Management and the psychologist, Sec. II, Book 4, Paul S. Achilles; *Reading course in executive technique.* Carl Heyel, Editor. New York: Funk and Wagnalls Co., 1948. Pp. 64. $1.00

Methods of psychology. T. G. Andrews, Editor. New York: John Wiley and Sons, Inc., 1948. Pp. 716. $5.00.

Psychology for pastor and people. John S. Bonnell. New York: Harper and Brothers, 1948. Pp. 225. $2.50.

American opinion on world affairs in the atomic age. Leonard S. Cottrell, Jr. and Sylvia Eberhart. Princeton: Princeton University Press, 1948. Pp. 152. $2.50.

An introduction to color. Ralph M. Evans. New York: John Wiley and Sons, Inc., 1948. Pp. 340. $6.00.

Conference leader's guide. Bulletin No. 15. Waldo E. Fisher. Pasadena: California Institute of Technology, 1948. Pp. 28. $1.00.

Speech and voice correction. Emil Froeschels. New York: The Philosophical Library, 1948. Pp. 321. $6.00.

Two-way street. Eric F. Goldman. Boston: Bellman Publishing Co., Inc., 1948. Pp. 23. $1.25.

Child care and guidance. Helen C. Goodspeed, Esther R. Mason, and Elizabeth L. Woods. Philadelphia: J. B. Lippincott Co., 1948. Pp. 276. $2.40.

Take up thy bed and walk. David Hinshaw. New York: Institute for the Crippled and Disabled, 1948. Pp. 262. $2.75.

Under the ancestors' shadow. Francis L. K. Hsu. New York: Columbia University Press, 1948. Pp. 317. $3.75.

The nervous child. A symposium. Volume 7. Leo Kanner, Editor. New York: Child Care Publications, 1948. $5.00.

The Kelley statistical tables. Revised edition. Truman L. Kelley. Cambridge: Harvard University Press, 1948. $5.00.

The law of adoption in all 48 states. Morton L. Leavy. New York: Oceana Publications, Inc., 1948. Pp. 76. $1.00.

Resolving social conflicts. Kurt Lewin. New York: Harper and Brothers, 1948. Pp. 230. $3.50.

Nomography. Alexander S. Levens. New York: John Wiley and Sons, Inc., 1948. Pp. 176. $3.00.

The commonsense psychiatry of Dr. Adolf Meyer. Alfred Lief, Editor. New York: McGraw-Hill Book Co., Inc., 1948. Pp. 675. $6.50.

A greater generation. Ernest M. Ligon. New York: The Macmillan Co., 1948. Pp. 157. $2.50.

A laboratory manual in general experimental psychology. Norman L. Munn. Boston: Houghton Mifflin Co., 1948. Pp. 224. $2.50.

The selection and use of diagnostic categories in clinical counseling. Harold B. Pepinsky. California: Stanford University Press, 1948. Pp. 140. $2.00.

The psychiatric study of Jesus. Albert Schweitzer. Boston: The Beacon Press, 1948. Pp. 81. $2.00.

Psychology of personality. Second edition. Ross Stagner. New York: McGraw-Hill Book Co., Inc., 1948. Pp. 485. $5.00.

The psychology of abnormal behavior. Louis P. Thorpe and Barney Katz. New York: The Ronald Press Co., 1948. Pp. 877. $6.00.

Training and selection of supervisory personnel in the I. G. Farbenwerke, Ludwigshafen. Morris S. Viteles and Dewey L. Anderson. Washington, D. C.: U. S. Department of Commerce, 1947. Pp. 35. $1.00.

The adolescent child. W. D. Wall. London: Methuen and Co., Ltd., 1948. Pp. 206. 8s. 6d.

The abnormal personality. Robert W. White. New York: The Ronald Press Co., 1948. Pp. 613. $5.00.

Measuring and guiding individual growth. Ben D. Wood and Ralph Haefner. New York: Silver Burdett, 1948. Pp. 535.

Contemporary schools of psychology. Revised edition. Robert S. Woodworth. New York: The Ronald Press Co., 1948. Pp. 279. $3.00.

Local labor market research. Dale Yoder, Donald G. Paterson, et al. Minneapolis: University of Minnesota Press, 1948. Pp. 226. $3.50.

Collective bargaining in the office. Research Report No. 12. New York: American Management Association, 1948. Pp. 120. $5.00.

Survey of personnel practices in unionized offices. Research Report No. 13. New York: American Management Association, 1948. Pp. 38. $3.00.

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